2040 Regional Transportation Plan

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Carson Area
Metropolitan Planning Organization
CAMPO

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Executive Summary

Purpose and Goals

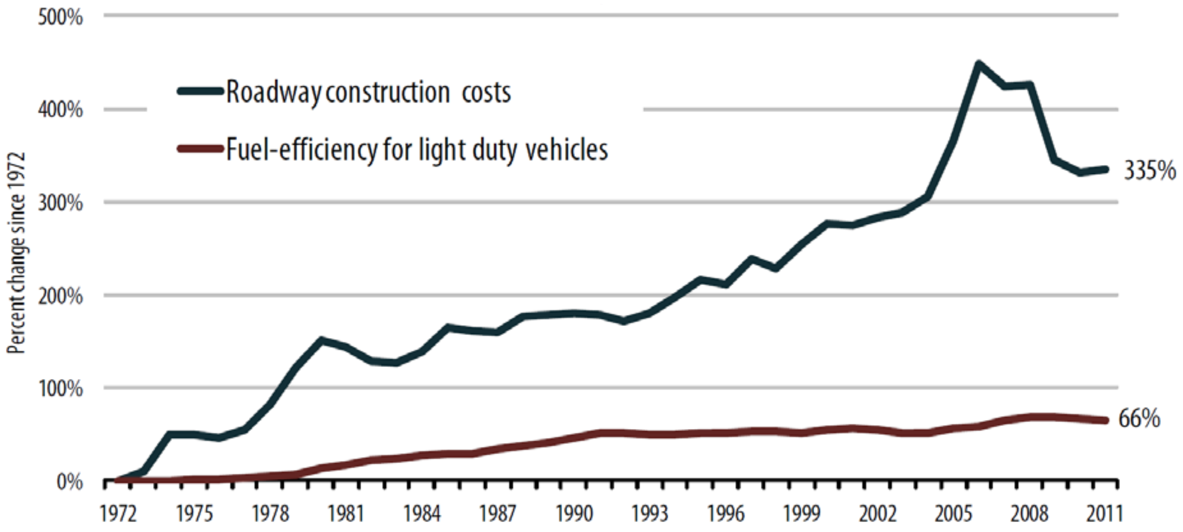
This Regional Transportation Plan is a long-term planning document, intended to analyze the regional transportation network and to identify current and future needs to maintain a safe, efficient, and sustainable transportation system. The Carson Area Metropolitan Planning Organization (CAMPO), who represents Carson City, northern Douglas County, and western Lyon County, has developed this plan. The intent of this plan is supported by the following five goals:

- **Increase the safety of the transportation system for all users**
- **Maintain a sustainable regional transportation system**
- **Increase the mobility and reliability of the transportation system for all users**
- **Maintain and develop a multi-modal transportation system that supports economic vitality**
- **Provide an integrated transportation system**

Current Conditions

The current condition of the transportation system includes a backlog of deferred maintenance projects due to insufficient revenue. The motor vehicle fuel tax that provides the majority of maintenance funds for Carson City, Douglas County, and Lyon County has remained unchanged since 1993 (Federal) and 1992 (State). Due to the rising costs of transportation improvements and the efficiency gains in vehicles, the purchasing power and the amount of tax collected per vehicle mile traveled has declined.

Figure ES.1 Construction Cost and Fuel-Efficiency Growth



Source: ITEP, A Federal Gas Tax for the Future, September 2013

Due to a statewide concern for insufficient transportation funds, Assembly Bill 191 has required all counties in Nevada to place a question on the November 2016 ballot asking the voters whether to index the motor vehicle fuel revenue tax to a specified inflation rate, except Washoe County, which already has fuel revenue indexing. If voters turn down the fuel revenue indexing, local decisions makers will continue to have difficult choices to make regarding the prioritization of capital improvement projects and maintenance projects. More information is provided in Chapter 3 *Funding*.

As all three-member agencies struggle to allocate funding resources, pavement management strategies are being used to maintain roadway pavement conditions at the lowest cost. All three agencies are in the process of developing or actively maintaining pavement management software. The software maintains an inventory of roadway conditions and schedules major and minor maintenance treatments to maximize the life span and condition of roadways. While this software is extremely useful to local agencies, the software does have a limitation. As the software aims to maintain roadway conditions, roadways that are no longer cost effective to maintain receive lower priority than new or recently constructed roadways. As a result, a balanced approach between maintaining better roads longer and repairing unsafe roadways must be achieved. More information is provided in Chapter 4 *Transportation System*.

The current transportation act, Fixing America's Surface Transportation Act, requires metropolitan planning organizations (MPOs) to establish a performance based planning approach. CAMPO has adopted the following thirteen objectives to support long-range and short-range investment decision making:

- **Reduce the number of transportation system fatalities**
- **Reduce the number of transportation system serious injuries**
- **Reduce the rate of transportation system fatalities**
- **Reduce the rate of transportation system serious injuries**
- **Improve the pavement condition of roadways in the CAMPO boundary**
- **Reduce the amount of roadways in poor or very poor condition**
- **Have no structurally deficient bridge decks in the CAMPO boundary**
- **Increase the number of ADA compliant transportation facilities**
- **Improve transit system efficiencies and accessibilities**
- **Maintain or improve travel times**
- **Improve travel times on major truck routes during peak hours**
- **Foster quality of life in the CAMPO boundary by increasing transportation choices and access to transportation services for all users**
- **Accommodate additional modes of transportation on existing transportation facilities**

In compliance with federal regulations and to enhance regional planning efforts, CAMPO in coordination with the Nevada Department of Transportation and Nevada's three other MPOs, have established performance measures to track progress towards the plan's objectives. The introduction of measures into CAMPO's regional transportation plan will establish a baseline of information for future measures and will allow for the future evaluation of investment into the transportation system. CAMPO will work with NDOT to establish the required targets needed to meet performance measure objectives and federal requirements. CAMPO's 2040 Regional Transportation Plan has been amended to incorporate required safety targets. Appendix A documents targets and supporting material.

Future Demand

Over the next 25 years, demand on the transportation system will grow and evolve. In the short term, over the next four years, population growth for the Carson area is forecasted to be modest with an average growth rate of 1% between Carson City, Douglas County, and Lyon County. The Carson area is still recovering from the recession when the area experienced slight population declines. As Northern Nevada's economy recovers and strengthens, higher growth rates and demand on the Transportation System should be expected. Higher growth rates, such as 8%-10% that were experienced in the mid 2000's are not predicted in the short term, but are possible.

Figure ES.2 CAMPO Population Projections to 2040

	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040
Carson City	54,694	55,168	55,945	56,823	57,661	58,272	61,933	65,594	69,254	72,915
Douglas County	48,347	48,220	48,171	48,190	48,230	48,072	47,767	47,462	47,157	46,852
Lyon County	53,652	54,229	55,404	56,768	58,112	58,688	63,597	68,506	73,415	78,324
Metropolitan Planning Area	84,204	85,046	85,896	86,755	87,623	88,499	93,013	97,758	102,745	107,986

Source: Nevada State Demographer: Nevada County Age, Sex, Race, and Hispanic Origin Estimates and Projections 2000 to 2033, 2035 and 2040 projections were estimated by CAMPO staff.

Population estimates anticipate a growing senior population that will necessitate investment in safety improvements to address seniors with changing needs, related to eyesight, hearing, and reaction times. Additionally, investment in public transportation and pedestrian and bicycle facilities will be important to provide an aging population with mobility and independence, along with improved integration and mobility for all system users.

Figure ES.3 Percentage of the Population 60 Years and Older

Member Agency	2010	2020	2030
Carson City	24%	29%	36%
Douglas County	30%	37%	39%
Lyon County	24%	27%	28%

Source: Nevada State Demographer Nevada County Age, Sex, Race, and Hispanic Origin Estimates and Projections 2000 to 2033

The land use in the CAMPO Area has experienced little change in recent years due to low development pressure. As Northern Nevada's economy strengthens, so will development pressures. The Nevada Department of Transportation is currently constructing two influential transportation projects in Northern Nevada that will have an effect on future land use and transportation patterns. Construction of the Carson City Freeway extension and the USA Parkway will improve access to employment for this entire region. Completion of the Carson City Freeway is anticipated in the Spring of 2017, and the completion of the USA Parkway is anticipated in December 2017. Due to the shortened travel times from these improvements, additional traffic on the Highway 395 corridor between Douglas County and Carson City and on the Highway 50 corridor between Dayton and Carson City may be expected. To minimize congestion in these corridors, appropriately timed investment in access management, bottleneck removal, capacity building, and incident management coordination, are to be considered as needed.

Complete Streets

At a local level, a strategy to improve the mobility, accessibility, and integration of the transportation system will include investment in Complete Streets. Complete Streets are streets for everyone, designed and operated to enable safe access and comfortable accommodation for all users of all ages and abilities, including pedestrians, bicyclists, transit riders, and motorists of all types. National studies demonstrate Complete Streets provide a better quality of life. The majority of participants in a Carson area transportation system survey felt that the transportation system influences their quality of life. To incorporate Complete Streets into the Carson area transportation system, local and state agencies should take advantage of investment opportunities when choosing roadway maintenance projects, roadway construction and reconstruction projects, and utility projects affecting roadways. Opportunities may be found through coordination between agencies and within agencies. The CAMPO network is set to develop a strong multi-modal system. A multi-modal system is characterized by several different modes of activity such as walking, biking, driving, and public transportation. The advantages of a multi-modal network include:

- Improved accessibility
- Increased connectivity
- Increased physical activity
- Improved safety

Safety Trends

In January 2012, the Federal Highway Administration (FHWA) began promoting the implementation of proven safety countermeasures. Through research, these safety measures have shown great effectiveness in improving safety. Information on each countermeasure is available on the Federal Highway Administration website at the following link: http://safety.fhwa.dot.gov/provencountermeasures/.

Roundabouts
Corridor Access Management
Backplates with Retroreflective Borders
Longitudinal Rumble Strips and Stripes on Two-Lane Roads
Enhanced Delineation and Friction for Horizontal Curves
Safety Edge$_{SM}$
Medians and Pedestrian Crossing Islands in Urban and Suburban Areas
Pedestrian Hybrid Beacon
Road Diet

Public Transportation

Public transportation provides improved mobility and access throughout the CAMPO Area. Presently, the principal benefit is safe and reliable transportation for the transit dependent population, a demographic that is anticipated to grow due to longer life spans and Nevada's attractive retirement atmosphere. Due to the dispersed pattern of residential, employment areas, and the region's mild traffic congestion, public transportation is not the preferred mode of travel. However, public transit provides an important complementary resource to active transportation and ride sharing users, allowing users to pair public transportation with other modes of travel. Public transportation provides access to jobs, community facilities, retail establishments, and healthcare facilities to individuals who cannot afford or are unable to drive a personal vehicle. Additionally, public transportation reduces traffic congestion and transportation emissions, providing a regional benefit.

The Future

The future of transportation will have a meaningful effect on society's safety, pollution levels, movement of goods, and productivity. Intelligent technology systems, smart cars, autonomous vehicles, unmanned aerial vehicles, and the Hyperloop system are emerging technologies that will in some way impact the Carson area by the year 2040. Appropriately planning for these technologies and the influence they will have to our region is recommended. Vehicle crashes, vehicle emissions, stormwater pollution from transportation facilities, and unproductive travel times are all realities of the Carson area transportation system. Some of the emerging technologies might not exist in the Carson area in the next 25 years, but they will still have an impact on our region and our quality of life.

Intelligent Technology Systems (ITS)

ITS includes a variety of technological engineering. Examples of ITS include timing of traffic signals to reduce congestion during peak travel times, remote metering to identify traffic volumes, remote or automated system controls so the transportation system can react to changing conditions, and system communication to improve emergency response time or to inform drivers of approaching conditions. The primary benefits of ITS include creating a safer transportation system and reducing congestion. However, if autonomous vehicles continue to emerge, the infrastructure and software used in ITS may be mutually beneficial to the autonomous vehicle industry.

Smart cars

Smart cars are commonly considered small compact cars; however, the term smart car is evolving. While being efficient is typically one aspect, new technology is being incorporated for safety. Smart car technology can include crash avoidance, night-vision enhancements, and automated communication technology, to communicate with the transportation network to inform the driver or notify emergency services. Manufacturers are already offering some of these technologies, while others are still in development.

Autonomous vehicles

The autonomous vehicle is not a new concept; however, investment from manufacturers, research institutions, and governments has recently been growing. The State of Nevada has created public policy allowing the testing of autonomous vehicles on public roadways. Among other benefits, autonomous vehicles would provide increased mobility, safety, and higher productivity.

Unmanned Aerial Vehicles (UAV)

The technology of UAVs is being embraced by the State of Nevada. The use of UAVs in emergency response, infrastructure inspections, and product delivery is currently emerging.

Hyperloop System

The Hyperloop system is a high-speed mode of travel, which could potentially reach a top speed of 760 miles per hour. The Hyperloop system involves building a full-length tube between destinations within which a transport pod carrying passengers or cargo is levitated by magnets and accelerated through a controlled environment.

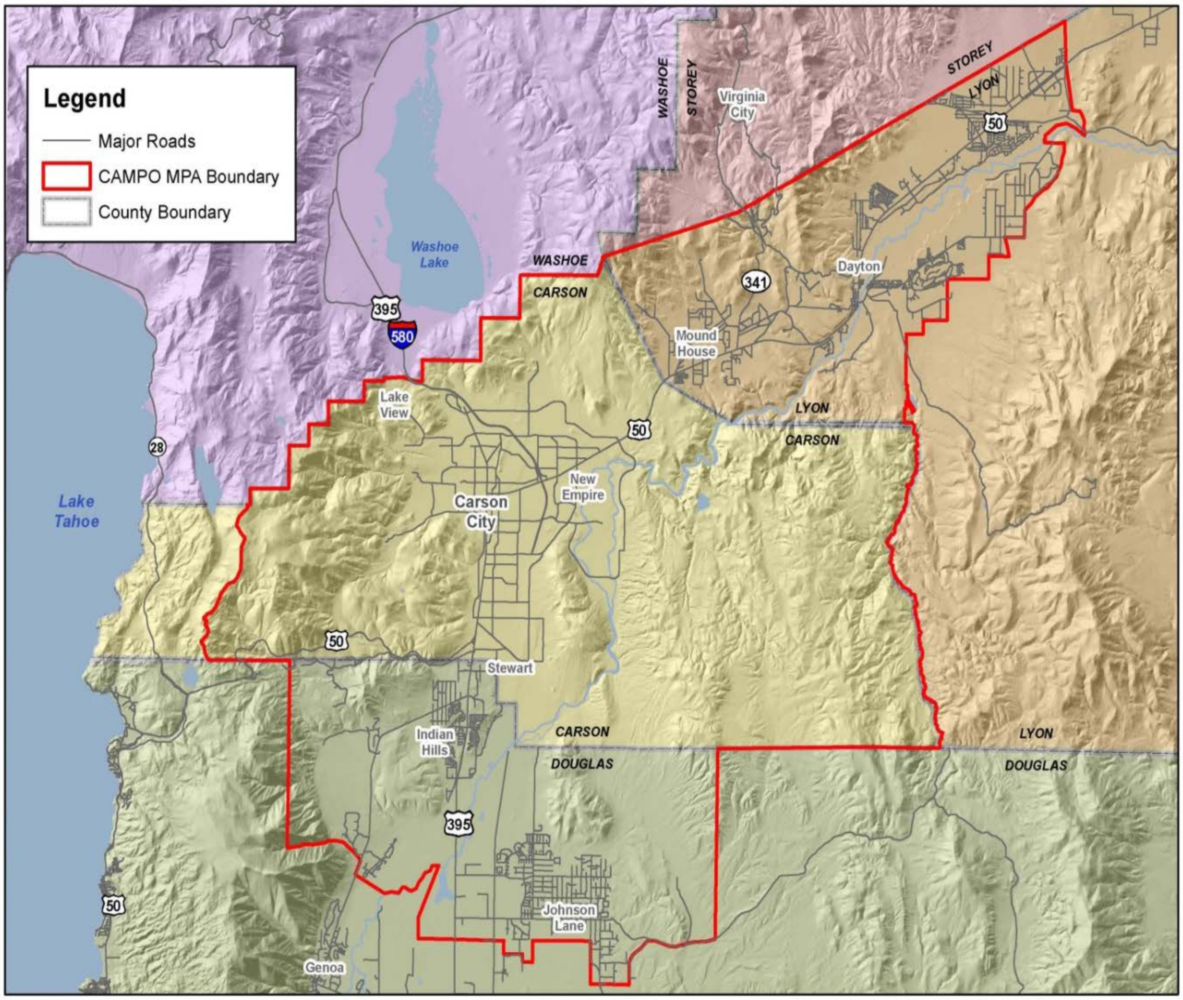
As these technologies emerge, transportation professionals will need to be mindful of how the transportation system will evolve. Appropriately planning for these technologies may help to maximize investment benefits by providing solutions for today and preparing for the future. There may be improvements to our transportation system that could accommodate or amplify the benefits of new technology. Planning for these transportation trends will help the Carson Area Metropolitan Planning Organization and its three member agencies successfully plan for the year 2040.

Chapter 1: Overview and Regulatory Framework

The Carson Area Metropolitan Planning Organization (CAMPO) is a federally recognized metropolitan planning organization (MPO), formed on February 26, 2003. Creation of the MPO was required since the Carson City urbanized area exceeded a population of 50,000. The CAMPO is the designated local decision-making body responsible for carrying out the metropolitan transportation planning process for the Carson City urbanized area.

The metropolitan planning area (MPA) boundary encompasses nearly all of Carson City (with the exception of the area within the Tahoe Basin) and portions of northern Douglas County and western Lyon County, including the Dayton Valley area. Map 1.0 depicts the MPA boundary.

Figure 1.0 CAMPO Boundary Map



CAMPO Roles and Responsibilities

The CAMPO is governed by a seven (7)-member board consisting of the five (5) members of the Carson City Regional Transportation Commission (RTC), one (1) member representing Douglas County, and one (1) member representing Lyon County. A representative from the Nevada Department of Transportation (NDOT) sits on the board serving as an ex officio, non-voting member. Carson City provides the staffing necessary to execute the daily functions and responsibilities of the MPO.

The primary responsibility of CAMPO is to ensure existing and future expenditures for transportation projects and programs are based on a continuing, cooperative and comprehensive (3-C) planning process. The CAMPO does not own nor operate the transportation systems they serve; rather it serves in the overall coordination and consensus-building role in planning and programming funds for projects and operations.

Among other state and federal requirements, CAMPO is required to develop a regional transportation plan (RTP) with a minimum 20-year planning horizon and a transportation improvement program (TIP) with a four-year horizon.

Federal Requirements

Federal regulations (23 CFR, §450.322) address the development and content of a regional transportation plan (also referred to as a metropolitan transportation plan).

In compliance with federal requirements, this 20-year transportation plan addresses the following subjects.

- Projected demand on the CAMPO transportation system
- Long and short range strategies to improve performance of the transportation system
- Evaluation of transportation facilities that serve national and regional transportation
- Proposed improvements with sufficient detail to develop cost estimates
- Discussion on environmental mitigation strategies to address impacts of the transportation plan on the environment
- Pedestrian and bicycle facilities
- Enhancement activities, as appropriate
- Financially constrained implementation plan

Transportation Legislation

On December 4, 2015, the President signed into law the Fixing America's Surface Transportation Act, or "FAST Act" - the first Federal law in over ten years to provide long-term funding certainty for surface transportation. The FAST Act authorizes $305 billion over fiscal years 2016 through 2020 for the Department of Transportation’s highway, highway and motor vehicle safety, public transportation, motor carrier safety, hazardous materials safety, rail, and research, technology and statistics programs.

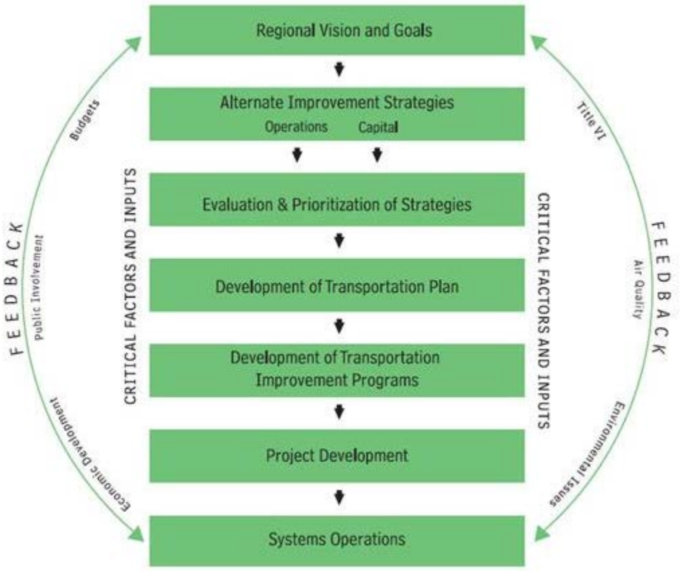
The previous transportation act was enacted in July 2012, and is known as the Moving Ahead for Progress in the 21st Century Act (MAP-21). This act authorized $105 billion for surface transportation programs in Federal fiscal years (FFY) 2013 and 2014. Between 2014 and December 2015, continuing resolutions extended MAP-21 funding.

Performance Based Planning

MAP-21 and the FAST Act require metropolitan planning organizations to implement performance-based planning and programming (PBPP). This involves integrating performance management concepts in to the transportation planning and programming process. PBPP uses data to support long-range and short-range investment decision-making. The process includes having goals, objectives, and targets for the transportation system. Additionally, PBPP requires the selection of performance measures for consistent comparison and analysis overtime to guide investment priorities.

Transportation planning includes a cooperative and performance-driven process by which long and short-range transportation improvement priorities are determined. Metropolitan planning organizations (MPOs), States, and transit operators conduct transportation planning, with active involvement from the traveling public, the business community, community groups, environmental organizations, and freight operators.

Figure 1.1 Transportation Planning Flow Chart


Regional Vision and Goals
Alternate Improvement Strategies
Operations
Capital
Evaluation & Prioritization of Strategies
Development of Transportation Plan
Development of Transportation Improvement Programs
Project Development
Systems Operations
CRITICAL FACTORS AND INPUTS
CRITICAL FACTORS AND INPUTS
FEEDBACK
Budgets
Public Involvement
Economic Development
FEEDBACK
Title VI
Air Quality
Environmental Issues

The metropolitan transportation planning process shall be continuous, cooperative, and comprehensive, and provide for consideration and implementation of projects, strategies, and services that will address the following factors:

(1) Support the economic vitality of the metropolitan area, by enabling global competitiveness, productivity, and efficiency
(2) Increase the safety of the transportation system for motorized and non-motorized users
(3) Increase the security of the transportation system for motorized and non-motorized users
(4) Increase accessibility and mobility of people and freight
(5) Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns
(6) Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight
(7) Promote efficient system management and operation
(8) Emphasize the preservation of the existing transportation system
(9) Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation; and
(10) Enhance travel and tourism

MAP-21 National Performance Goals
The planning process and factors support the National Performance Goals established in MAP-21 legislation. These goals include:

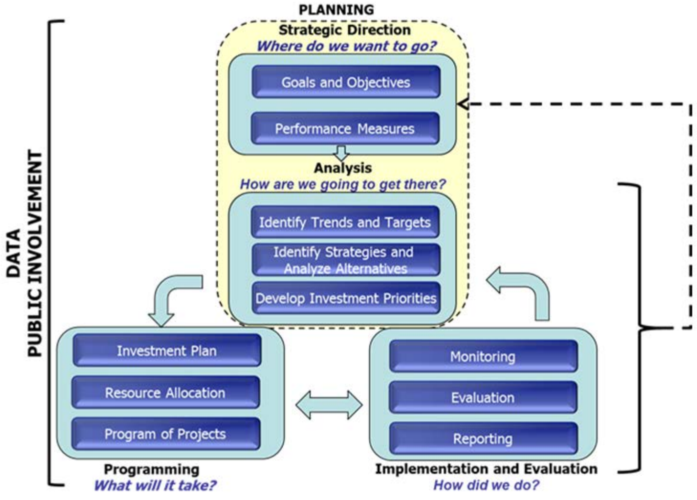
- **Safety** - To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- **Infrastructure Condition** - To maintain the highway infrastructure asset system in a state of good repair
- **Congestion Reduction** - To achieve a significant reduction in congestion on the National Highway System
- **System Reliability** - To improve the efficiency of the surface transportation system
- **Freight Movement and Economic Vitality** - To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
- **Environmental Sustainability** - To enhance the performance of the transportation system while protecting and enhancing the natural environment
- **Reduced Project Delivery Delays** - To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices

Strategic Direction

PBPP is based on a strategic direction, which is used to shape decisions about policies and investments. In the transportation planning process, strategic direction is based upon a vision for the future, as articulated by the public and stakeholders. This vision often encompasses broad community factors such as quality of life, economic vitality, and environmental quality. PBPP includes:

- **Goals and Objectives -** Stemming from a state or region's vision, goals address key desired outcomes, and supporting objectives (specific, measurable statements that support achievement of goals) play a key role in shaping planning priorities
- **Performance Measures -** Performance measures support objectives and serve as a basis for comparing alternative improvement strategies (investment and policy approaches) and for tracking performance over time.
- **Planning Analysis** - Driven by data on performance, along with public involvement and policy considerations, agencies conduct analysis to develop investment and policy priorities:
- **Identify Trends and Targets -** Preferred trends (direction of results) or targets (specific levels of performance desired to be achieved within a certain timeframe) are established for each measure to provide a basis for comparing alternative packages of strategies and measuring actual progress. This step relies upon baseline data on past trends, tools to forecast future performance, and information on possible strategies, available funding, and other constraints.
- **Identify Strategies and Analyze Alternatives -** Performance measures are used to assess strategies and to prioritize options. Scenario analysis may be used to assess alternative packages of strategies, to consider alternative funding levels, or to explore what level of funding would be required to achieve a certain level of performance.
- **Develop Investment Priorities -** This step builds on strategy analyses, and involves prioritizing strategies and investments and making tradeoffs between different goal areas with a system-level understanding of the level and mix of investments in a given area, for inclusion in the LRTP and related supporting plans. This step requires prioritizing what performance outcomes are most important. This process of prioritization should account for performance outcomes using analytical methods, as well as policy priorities, and concerns such as equity, environmental justice, and other considerations.

Figure 1.2 Strategic Direction Flow Chart



Programming

Programming involves selecting specific investments to include in an capital plan and/or in a State Transportation Improvement Plan (STIP) or Transportation Improvement Program (TIP). In a PBPP approach, programming decisions are made based on their ability to support attainment of performance targets or contribute to desired trends, and account for a range of factors.

- **Investment Plan** - To connect the Long-Range Transportation Plan (LRTP), which has an outlook of at least 20 years, to selection of projects in a TIP/STIP, some areas develop a mid-range (e.g., 10 year) investment plan or investment program. The investment plan may essentially be incorporated into the LRTP for an MPO, or may involve a set of investment plans for a State DOT or transit agency, addressing different modes, districts, or program areas.
- **Resource Allocation / Program of Projects** - Project prioritization or selection criteria are used to identify specific investments or strategies for a capital plan or TIP/STIP. Projects included in the TIP/STIP are selected on the basis of expected performance, and show a clear link to meeting performance objectives.

Implementation and Evaluation

These activities occur throughout implementation on an on-going basis, and include:

- **Monitoring** - Gathering information on actual conditions.
- **Evaluation** - Conducting analysis to understand to what extent implemented strategies have been effective.
- **Reporting** - Communicating information about system performance and the effectiveness of plans and programs to policymakers, stakeholders, and the public.

The data generated through monitoring system conditions and evaluating the impacts of investments feeds into subsequent cycles of planning, and are critical for refining objectives, measures and targets, and for informing prioritization of future investments.

A significant aspect of PBPP is that each step in the process is clearly connected to the next. Goals tie directly into specific, measureable and actionable objectives, which are often developed in connection with the selection of performance measures. These objectives and performance measures, in turn, are used to develop targets or desired trends and are a basis for selecting and analyzing strategies for the LRTP. The LRTP priorities are tied into project selection decisions for the TIP/STIP. Public involvement and data from monitoring and evaluation efforts are used throughout the process.

Federal Planning Priorities

The United States Department of Transportation encourages Metropolitan Planning Organizations (MPO) to incorporate three priorities, also known as planning emphasis areas, into their transportation planning efforts. The priorities are termed MAP-21/FAST Act Implementation, Regional Models of Cooperation, and Ladders of Opportunity. The Planning 2015-2016 Emphasis Areas are considered in CAMPO's Unified Planning Work Program and incorporate the planning activities below:

MAP-21/FAST Act Implementation

- Transition to Performance Based Planning and Programming
- Develop and implement a performance management approach to transportation planning and programming

Models of Regional Planning Cooperation

- Promote cooperation and coordination across MPO boundaries and State boundaries on transportation plans and programs, corridor studies, and regional projects
- Collaboration by sharing data collection, data storage and analysis, analytical tools, and performance based planning efforts

Ladders of Opportunity

- Improve access to essential services such as housing, employment, health care, schools/education, and recreation
- Identify transportation connectivity gaps to essential services

*Additional information can be found at the link below:
http://www.fhwa.dot.gov/planning/processes/metropolitan/mpo/fy_2016/index.cfm

Chapter 2: Goals, Objectives, and Performance Measures

This chapter contains adopted goals, objectives, and performance measures for this transportation plan. The purpose of these goals, objectives, and performance measures are to help guide and evaluate investment into the Carson Area transportation network. Public comment, previous goals from CAMPO's 2035 Regional Transportation Plan, and new federal legislation were leading factors in the development of the goals, objectives, and performance measures below:

Goals

- **Increase the safety of the transportation system for all users**
- **Maintain a sustainable regional transportation system**
- **Increase the mobility and reliability of the transportation system for all users**
- **Maintain and develop a multi-modal transportation system that supports economic vitality**
- **Provide an integrated transportation system**

Objectives and Performance Measures

Initiated with the previous transportation bill, MAP-21, and continued with the FAST Act, federal law now requires MPOs to establish and track performance measures. Commonly referred to as performance based planning and programing, the established performance measures are intended to help assess the effectiveness of investment into the transportation network. The objectives and performance measures in this plan support one of the plan's five goals. Additionally, the objectives and performance measures have been developed through coordination with state and regional planning partners to allow for statewide consistency and comparison.

In addition to the establishment of performance measures, this plan provides baseline figures for future evaluation. The carefully selected objectives and performance measures were chosen based on data that is consistent and readily available. The objectives for this plan are believed to be realistic and measurable.

The Safety Performance Management Final Rule adds Part 490 to title 23 of the Code of Federal Regulations to implement performance management requirements including specific safety performance measures for the purpose of the Highway Safety Improvement Program (HSIP). Together, these regulations will improve data, foster transparency and accountability, and allow Federal investments in safety improvements. The Nevada Department of Transportation (NDOT) first established their statewide targets on August 31, 2017. MPO's are required to establish their targets each year within 180 days of establishment of NDOT's targets. CAMPO's 2040 Regional Transportation Plan has been amended to incorporate required safety targets. Appendix A documents targets and supporting materials.

Goal: Increase the Safety of the Transportation System for All Users

Objective: Reduce the number of transportation system fatalities

- Performance Measure: Number (5-year rolling average) of fatal crashes in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of fatal crashes involving a bicyclist or pedestrian in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of fatal crashes involving trucks

Objective: Reduce the number of transportation system serious injuries

- Performance Measure: Number (5-year rolling average) of serious crashes (injuries classified as type A on the KABCO scale) in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of serious injuries involving a bicyclist or pedestrian in the CAMPO boundary

Objective: Reduce the rate of transportation system fatalities

- Performance Measure: Rate of fatalities calculated by the number of fatalities as a 5-year rolling average per 100 million VMT (vehicle miles traveled) in the CAMPO boundary

Objective: Reduce the rate of transportation system serious injuries

- Performance Measure: Rate of serious injuries classified as type A on the KABCO scale calculated by the number of crashes as a 5-year rolling average per 100 million VMT (vehicle miles traveled) in the CAMPO boundary

2014 Safety Performance Measures

- 1.6* - Number of Fatal Crashes
- 16.8* - Number of Serious Injury*** Crashes
- 0.2* - Number of Fatal Crashes involving a Bicyclist or Pedestrian
- 2.0* - Number of Serious Injury*** Crashes involving a Bicyclist or Pedestrian
- 0.28** - Rate of Fatal Crashes
- 2.94** - Rate of Serious Injury*** Crashes
- 0.0 - Number of Fatal Crashes involving Trucks

*The number is expressed as a five year rolling average
**Rate is expressed as the number of crashes per 100 million vehicle miles traveled
***A serious injury is defined by the National Safety Council (NSC) as incapacitating as defined by the KABCO scale

Goal: Maintain a Sustainable Regional Transportation System

Objective: Improve the pavement condition of roadways in the CAMPO boundary

- Performance Measure: Average PCI rating for collector and arterial roadways within the CAMPO boundary by jurisdiction (Carson City, Douglas County, and Lyon County)

Objective: Reduce the amount of roadways in poor or very poor condition

- Performance Measure: Percentage of roadways with a PCI rating of 55 or below in the CAMPO boundary by jurisdiction (Carson City, Douglas County, and Lyon County)

Objective: Have no structurally deficient bridge decks in the CAMPO boundary

- Performance Measure: Percentage of structurally deficient bridge decks with a roadway functional classification of 1-5, as approved by NDOT

Sustainability Performance Measures

0% of structurally deficient bridge decks (category 1-5 roadways) in the Carson Area Metropolitan Planning Organization boundary

- 62.9 – Carson City average PCI for collector and arterial roadways
- 56.0 – Douglas County average PCI for collector and arterial roadways
- TBD – Lyon County average PCI for collector and arterial roadways
- 24 % – Carson City percentage of roadways with a PCI of 55 or below
- 14 % – Douglas County percentage of roadways with a PCI of 55 or below
- TBD % – Lyon County percentage of roadways with a PCI of 55 or below

Goal: Increase the Mobility and Reliability of the Transportation System for All Users

Objective: Increase the number of ADA compliant transportation facilities

- Performance Measure: The number of transportation facilities improved to ADA standards within the CAMPO boundary by jurisdiction

Objective: Improve transit system efficiencies and accessibilities

- Performance Measure: The number of passengers per revenue hour/mile/day for Jump Around Carson and RTC Intercity
- Performance Measure: The cost per revenue hour/mile/trip for Jump Around Carson and RTC Intercity
- Performance Measure: The number of passengers per day for Jump Around Carson and RTC Intercity
- Performance Measure: Monthly ridership for Jump Around Carson (fixed route and paratransit) and RTC Intercity
- Performance Measure: Farebox recovery rate for Jump Around Carson and RTC Intercity
- Performance Measure: On-time performance (departure from a time point between zero and five minutes is considered on time) for Jump Around Carson’s fixed route and RTC Intercity

Objective: Maintain or improve travel times

- Performance Measure: Travel Demand Model Estimated Travel Times (see Chapter 4 for baseline numbers)

Fiscal Year 2015 Performance Measures

- 32 curb ramps and 1.3 miles of sidewalk improved to ADA standards in Carson City for the 2014/2015 fiscal year
- 2 intersections improved to ADA standards in Douglas County for the 2014/2015 fiscal year
- TBD transportation facilities improved to ADA standards in Lyon County for the 2014/2015 fiscal year

Figure 2.0 Transit Performance Measures

Fiscal Year 2015	Jump Around Carson (Fixed Route)	Jump Around Carson (Paratransit)	Intercity (Between Carson City and Reno)
Number of passengers per revenue hour	12.84	2.24	10.90
Number of passengers per revenue mile	1.00	0.26	0.35
Cost per revenue hour	$52.97	$43.80	$87.14*
Cost per trip	$4.13	$19.52	$7.90*
Cost per revenue mile	$4.11	$5.02	$2.75*
Number of passengers per revenue day	631.54	61.51	142.00
Monthly ridership	16,420	1,599	3,009
Farebox recovery rate	8.73%	8.35%	42.80%
On-time performance	96.50%	98.20%	56.00%

* Cost to Carson City Regional Transportation Commission

Goal: Maintain and Develop a Transportation System that Supports Economic Vitality

Objective: Improve travel times on major truck routes during peak hours

- ➢Performance Measure: Travel times, during peak hours, from the travel demand model for U.S. Highway 395 and Highway 50

Objective: Foster quality of life in the CAMPO boundary by increasing transportation choices and access to transportation services for all users

- ➢Performance Measure: Percentage of objectives met (measured with next plan)

Figure 2.1 Travel Time Performance Measures

Travel Times in Minutes between Metropolitan Planning Area Gateways		**Year 2015**	
From	**To**	**AM**	**PM**
U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	U.S. Hwy 50 East (Near Chaves Road)	30.2	39.4
	U.S. Hwy 395 South (2000 feet south of Johnson Lane)	23.1	30.4
	U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	16.8	18.7
U.S. Hwy 50 East (Near Chaves Road)	U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	35	33.6
	U.S. Hwy 395 South (2000 feet south of Johnson Lane)	48.2	53.6
	U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	41.9	41.9
U.S. Hwy 395 South (2000 feet south of Johnson Lane)	U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	26.4	26.4
	U.S. Hwy 50 East (Near Chaves Road)	46.6	55.2
	U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	16.1	15.3
U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	17.3	18.5
	U.S. Hwy 50 East (Near Chaves Road)	37.5	47.3
	U.S. Hwy 395 South (2000 feet south of Johnson Lane)	13.3	19.1

Goal: Provide an Integrated Transportation System

Objective: Accommodate additional modes of transportation on existing transportation facilities

- ➢Performance Measure: Number of Complete Street projects constructed within the CAMPO boundary

- ➢Performance Measure: Miles of bicycle lane added or reconstructed

- ➢Performance Measure: Miles of sidewalk added or reconstructed

- ➢Performance Measure: Miles of shared use path added or reconstructed

Fiscal Year 2015 Integrated Transportation System Performance Measures

- 0.0 Complete Street projects constructed or reconstructed
- 0.35 miles of bicycle lane added or reconstructed
- 0.25 miles of sidewalk added or reconstructed
- 0.0 miles of shared use path added or reconstructed

Chapter 3: Funding

The CAMPO transportation network of roads, bike lanes, sidewalks, signals, signs, and countless other transportation facilities provides mobility to its users, allowing for a high quality of life. A combination of local, regional, state, and federal funds maintain and improve this network; however, the current level of funding requires local and regional decision makers to prioritize investment into the transportation network. To sustain an effective transportation network, a careful balance between investing in maintenance projects and capital projects will need to be achieved. Capital projects include the construction or reconstruction of roadways, capacity improvements, safety improvements, or design improvements. To support the continued need for responsible investment, a goal of this plan is to maintain a sustainable regional transportation system, understanding that funding for the transportation network is limited.

All jurisdictions are required to have a balanced budget, meaning budgeted expenses cannot exceed anticipated revenue. For the purpose of consistency, CAMPO, NDOT, and Nevada’s other three MPOs developed the following financial assumptions for future revenues and expenditures. Revenue projections assume a conservative 2% annual growth rate. Expenditures used a 10-year rolling average of the Producer Price Index (PPI) to develop a 3.5% inflation rate for construction costs. It was agreed that historical cost data provides reasonable justification for cost estimates going forward.

The need for timely maintenance to transportation assets is critical, the longer maintenance is deferred the more expensive transportation improvement projects will become. Additionally, the longer maintenance is deferred, the faster roadway conditions will deteriorate. Both Carson City and Douglas County have begun working with the University of Reno’s (UNR) Pavement Engineering Program to improve the timing of transportation investments. As identified through the partnership, there are cost effective times in the life of a roadway when certain maintenance treatments should be applied to maximize investment benefits. Due to the backlog of deferred maintenance, that member agencies are experiencing, and the need to address deteriorating unsafe roadways, the windows of opportunity for properly timed maintenance improvements are being missed.

Due to an inflation rate that out paces revenue growth, 3.5% and 2.0% respectively, levels of expenditures will need to be reduced to achieve balanced budgets.

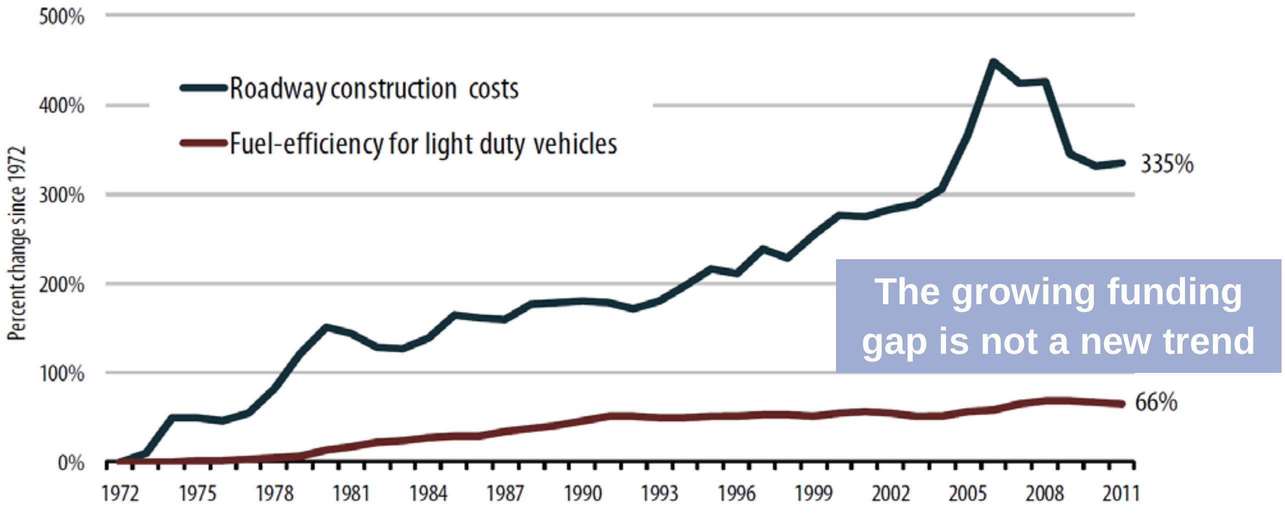
Motor Vehicle Fuel Revenue Indexing

Due to a growing concern in the gap between funding and costs, a 2015 Assembly Bill (AB191) has required all counties, except Washoe County which already has fuel revenue indexing, to place a question on the November 8, 2016 ballot, asking voters to approve an annual increase to certain motor vehicle fuels taxes for a ten-year period. This annual increase is known as *Motor Vehicle Fuel Indexing*. The annual increase would be tied to the rate of inflation to help revenue keep pace with transportation costs.

The growing gap between motor vehicle fuel tax revenue and transportation costs are primarily due to two reasons:

1. The decline in purchasing power, due to the fact fuel tax is at a fixed rate, which causes inflation to erode revenue
2. The decline in the amount of gasoline sold per mile driven due to improved vehicle fuel-efficiency and other factors

Figure 3.0 Construction Cost and Fuel-Efficiency Growth



Source: ITEP, A Federal Gas Tax for the Future, September 2013

The intent of Motor Fuel Revenue Indexing is to enable taxes paid at the pump to better support the costs of maintaining and improving our transportation infrastructure. Where approved, counties will receive approximately 65% of the revenue generated by the indexing to fund roadway improvements and the State will receive the remaining 35% to fund roadway improvements on state roads. The State must spend the revenue in the county where it was collected. If approved, the measure will remain in place for a 10-year period, when counties will have the option to renew the measure by putting it back on the ballot for another vote. The Federal gas tax has not been increased since 1993 and the State fuel tax has not been increased since 1992.

*More information is located here: http://www.itep.org/itep_reports/2013/09/a-federal-gas-tax-for-the-future.php#.V2MZR2cm4fg.

Surface Transportation Program (STP) Funds

The Nevada Department of Transportation (NDOT) has recently agreed to provide Surface Transportation Program (STP) funds directly to CAMPO for the first time, and is expected to do so on an annual basis. The program provides flexible funding that may be used to preserve or improve the conditions and performance on any Federal-aid highway, including bridge and tunnel projects, pedestrian and bicycle infrastructure, or transit capital projects. As under the MAP-21 Transportation Act, the recent FAST Act directs the Federal Highway Administration (FHWA) to apportion STP funding to states, which then are responsible for apportioning an amount to areas in proportion to its urban population.

Based on the CAMPO's urban area population of approximately 63,000, it is anticipated that approximately $900,000 will be set aside for the CAMPO area, including Caron City, northern portions of Douglas County, and western portions of Lyon County, for 2017. The details of this arrangement are still being worked out, but this will mark a significant change for CAMPO since its inception over a decade ago. This reliable funding source will allow CAMPO member agencies to construct larger and more meaningful system improvements. STP funds are highly flexible in terms of what they can be used for and are a primary source of funding for MPOs across the country.

Financial Forecast

Revenue and Expenditures

This plan's financial forecast is based upon current equal levels of revenues and expenditures. Funding for transportation projects, capital improvements and maintenance, come from a variety of sources. With the exception of Surface Transportation Program funds and Federal Transit Administration (FTA) funds, the remainders of federal revenue sources are highly competitive. The State of Nevada does have funding available, but similar to federal dollars they are highly competitive. CAMPO staff and its member agencies aggressively compete for federal and state funds, however, due to project selection methods it is difficult to compete with Washoe and Clark counties with large populations and traffic volumes. Local funds make up a significant source of revenue for all three-member agencies. Local sources and funding levels differ between counties.

The total anticipated revenue for 2017 available for transportation improvements within the Carson Area is approximately 8.6 million dollars per year.

The anticipated revenue for this regional transportation plan are based on current revenue amounts budgeted by member agencies and the Nevada Department of Transportation.

Below is a list of funds that have been utilized for transportation improvements in the past by member agencies. More details on each fund are available in CAMPO's Transportation Improvement Program online at www.CarsonAreaMPO.com.

Federal Funds

- National Highway Performance Program (NHPP)
- Surface Transportation Program (STP)
- Highway Safety Improvement Program (HSIP)
- STP Set-aside, formerly Transportation Alternatives Program (TAP)
- FTA Section 5307 (Urbanized Area Formula Grants)
- FTA Section 5310 (Elderly Persons and Persons with Disabilities)
- FTA Section 5339 (Bus and Bus Facility Grants)
- TIGER Discretionary Grants
- Community Development Block Grant (CDBG)

State Funds

- State Highway Fund

Local Funds

- Carson City Regional Transportation Commission (RTC)
- Carson City Street Maintenance Fund (Motor Vehicle Fuel and Sales Tax)
- Carson City Quality of Life Initiative
- Carson City 1/8-cent Sales Tax
- Douglas County Regional Transportation Commission (RTC) Motor Vehicle Fuel Tax and Shared Revenue Tax
- Lyon County Regional Transportation Commission (RTC) Motor Vehicle Fuel Tax and Shared Revenue Tax

The following transportation improvement projects have been identified by CAMPO's member agencies and the Nevada Department of Transportation as financially feasible transportation improvements. The total cost of the planned improvements total approximately 68.1 million dollars.

Figure 3.1 Fiscally Constrained Transportation Improvements

Fiscally Constrained Transportation Improvements

Anticipated Year of Improvements 2017-2025

Agency	Project Description	Limits	Improvement
CC	Curry Street Improvement	Rhodes Street to Lake Glen Drive	Road enhancement to two lane road
CC	Roop Street Widening	Washington Street to Fifth Street	Widen to four lanes
CC	Saliman Road Widening	Fairview Drive to Colorado Street	Widen to four lanes
CC	William Street Corridor	Carson Street to Mills Park	Reduce to one lane per direction
CC	S. Carson Street Corridor*	Stewart Street to Freeway Interchange	Reduce to two lane per direction
CC	Sierra Vista Lane**	Pinion Hills Road to Mexican Dam	Road enhancements to two lane road
NDOT	U.S. 50 Drainage Improvements	Spooner Summit to Clear Creek Interchange	Drainage improvements
NDOT	I 580 Carson City Roadway Rehabilitation	William Street north to county line	Roadway rehabilitation

Anticipated Year of Improvements 2026-2040

Agency	Project Description	Limits	Improvement
NDOT	Full Interchange at Spooner Jct.	CC Freeway at U.S. 395/U.S. 50 W	Construct full interchange
LC	New Bridge Over Carson River	Dayton Valley Road to Chaves Road	Bridge over Carson River connecting Dayton Valley Rd to Chaves Road

*Additional funding is being sought and a corridor study is anticipated
**Grant funded project with 5% local match

To determine financial feasibility, the cost of the projects were totaled and allocated an annual cost. The annual cost is approximately 2.8 million dollars, which is within the annual anticipated revenue for the Carson Area of approximately 8.6 million dollars. The remaining funds, approximately 67%, are anticipated to be used for maintenance and operation expenditures.

The following transportation improvement projects have been identified by CAMPO's member agencies and the Nevada Department of Transportation as transportation improvements without available revenue. The total cost of the planned improvements total approximately 73.5 million dollars.

Figure 3.2 Proposed Transportation Projects in the Fiscally Unconstrained Plan

Fiscally Unconstrained Transportation Improvements			
Anticipated Year of Improvements 2017-2025			
Agency	**Project Description**	**Limits**	**Improvement**
CC	College Pkwy/Arrowhead Drive Connection	College Parkway to Arrowhead Drive	Construct two-lane extension
DC	Heybourne Road Construction	Stephanie Way to Johnson Lane	New two-lane road
CC	Hillview Drive Extension	Koontz Lane to Valley View Drive	Construct two-lane extension
DC	North Valley Construction	Off Topsy Lane for new development	New two-lane road
CC	Ormsby Blvd. Extension	Ash Canyon Road to Winnie Lane	Construct two-lane extension
CC	Snyder Avenue Realignment	Carson Street - East to Appion Way	Realignment and traffic signal
DC	Vista Grande Boulevard Construction	Topsy Lane to Jacks Valley Road	New two-lane road
Anticipated Year of Improvements 2026-2040			
Agency	**Project Description**	**Limits**	**Improvement**
DC	East Valley Road Alignment	Connection to Vicky Lane	New alignment
CC	Fifth Street Widening	Saliman Road to Lompa Ranch Entrance	Widen to four Lanes
DC	Johnson Lane Widening	U.S. 395 to Vicky Lane	Widen to four lanes
CC	Lompa Ranch N/S Connector	William Street to Fifth Street	Construct two-lane extension
CC	Robinson Street Extension	East into Lompa Ranch (N/S Connector)	Extension
DC	Stephanie Lane Widening	U.S. 395 to Santa Barbara Drive	Widen to four lanes

Transit Expenditures and Revenues

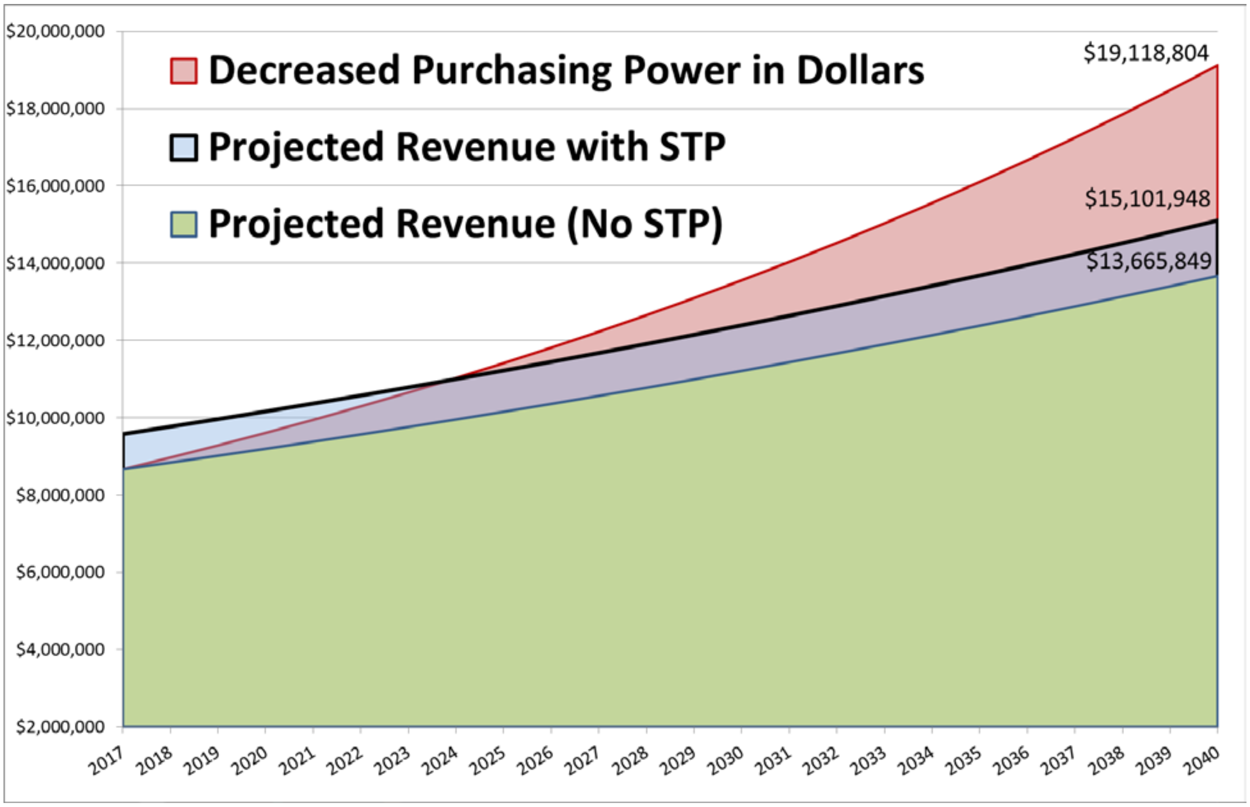
Due to the availability of Federal Transit Administration (FTA) Grants and limited local funding, transit expenditures are not anticipated to exceed available revenues. As a metropolitan planning organization, CAMPO is provided Federal funding through the FTA. FTA funding sources come in the form of grants that require local matching, typically, in a local match ratio of 50% or 20%. Transit operations and capital is dependent on these FTA funding sources. As long as local transit funding remains consistent, there should be sufficient local funds to leverage the necessary Federal grants to maintain current transit operations.

Conclusion

The need for timely maintenance to transportation assets is critical, the longer maintenance is deferred the more expensive transportation improvement projects will become. Additionally, the longer maintenance is deferred, the faster roadway conditions will deteriorate. Both Carson City and Douglas County have begun working with the University of Reno's (UNR) Pavement Engineering Program to improve the timing of transportation investments. As identified through the partnership, there are cost effective times in the life of a roadway when certain maintenance treatments should be applied to maximize investment benefits. Due to the backlog of deferred maintenance, that member agencies are experiencing, and the need to address deteriorating unsafe roadways, the windows of opportunity for properly timed maintenance improvements are being missed.

Due to an inflation rate that out paces revenue growth, 3.5% and 2.0% respectively, levels of expenditures will need to be reduced to achieve balanced budgets. Figure 3.3 demonstrates the decrease in purchasing power over time.

Figure 3.3 Decreased Purchasing Power



Chapter 4: Transportation System

The Carson area transportation system is of central importance to the region's economy and influential to the quality of life for people living and traveling in the Carson area. Only with a continued strategic investment into the region's transportation system will residents and the region's economy enjoy a sustainable transportation system. A successful investment strategy will be balanced, opportunity driven, supported by consensus, and continually evaluated. As required by the Federal government for use of federal funds, CAMPO is responsible for collecting data and tracking performance of investments. Performance measures designed to track progress toward adopted goals will allow CAMPO to evaluate regional investment.

Over the next 25 years, demand on the transportation system will grow and evolve. In the short term, over the next four years, population growth for the Carson area is forecasted to be modest with an average growth rate of 1% between Carson City, Douglas County, and Lyon County. The Carson area is still recovering from the recession when the area experienced slight population declines. As Northern Nevada's economy recovers and strengthens, higher growth rates and demand on the Transportation System should be expected. Higher growth rates, such as 8%-10% that were experienced in the mid 2000's are not predicted in the short term, but are possible.

Population estimates anticipate a growing senior population that will necessitate investment in safety improvements to address seniors with changing needs, related to eyesight, hearing, and reaction times. Additionally, investment in public transportation and pedestrian and bicycle facilities will be important to provide an aging population with mobility and independence, along with improved integration and mobility for all system users.

Construction of the Carson City Freeway extension and the USA Parkway will improve access to employment for this entire region. Completion of the Carson City Freeway is anticipated in the spring of 2017 and the completion of the USA Parkway is anticipated in December 2017. Both projects will affect the Carson area transportation system. Due to the shortened travel times from these improvements, additional traffic on the Highway 395 corridor between Douglas County and Carson City and on the Highway 50 corridor between Dayton and Carson City may be expected. To minimize congestion in these corridors, appropriately timed investment in access management, bottleneck removal, capacity building, and incident management coordination, are to be considered as needed.

At a local level, a strategy to improve the mobility, accessibility, and integration of the transportation system will include investment in Complete Streets. Complete Streets are streets for everyone, designed and operated to enable safe access and comfortable accommodation for all users of all ages and abilities; including pedestrians, bicyclists, transit riders, and motorists of all types. National studies demonstrate Complete Streets provide a better quality of life. Notably, the majority of participants in a Carson area transportation system survey felt that the transportation system influences their quality of life. To incorporate Complete Streets into the Carson area transportation system, local and state agencies should take advantage of investment opportunities when choosing roadway maintenance projects, roadway construction/reconstruction projects, and utility projects affecting roadways. Opportunities can be found through coordination between agencies and between intra agency departments. As local and state agencies perform deferred maintenance, utilization of pavement management software is encouraged to identify the most efficient investment opportunities.

Demand on the System

Population

The CAMPO area has a population of 83,370, comprised of the entire Carson City population of 55,274 and portions of Douglas and Lyon Counties, with 12,820 and 15,276 respectively. These population figures are from the 2010 census.

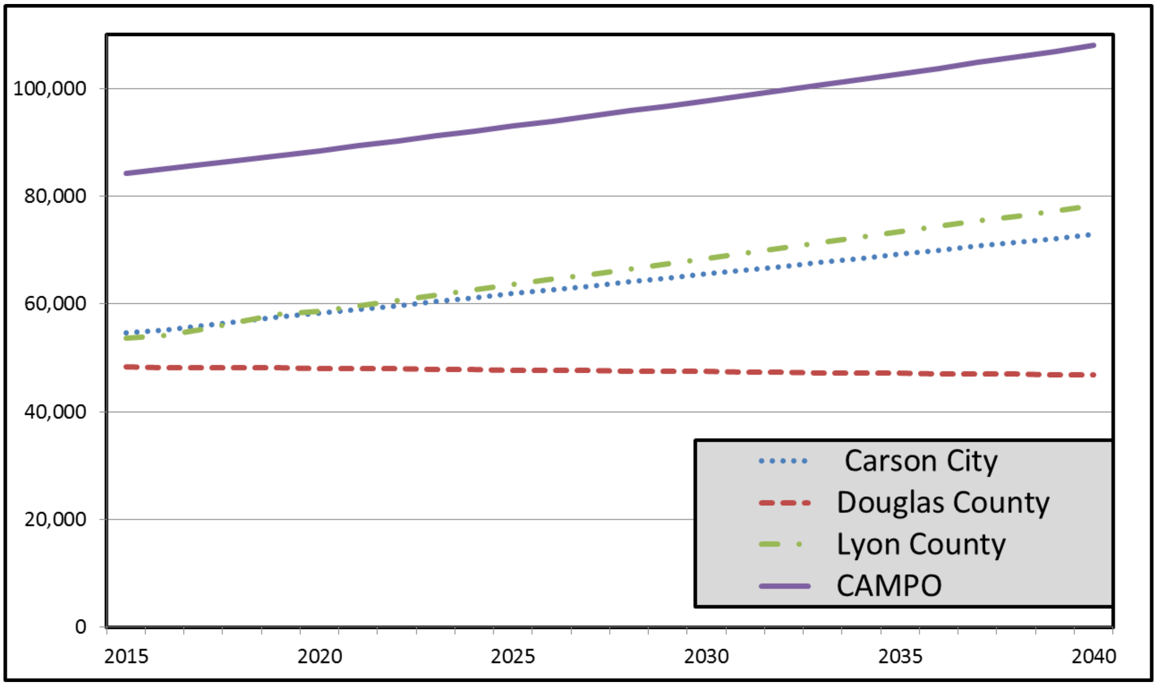
Figure 4.0 CAMPO 2010 Census Populations

CAMPO Members	Population within CAMPO	Percentage of Population
Carson City	55,274	66.3%
Douglas County	12,820	15.4%
Lyon County	15,276	18.3%
Total Population	83,370	

Source: 2010 Census

Since this plan is in the middle of a decennial census, population projections are derived from population estimates prepared by the Nevada State Demographer's Office. CAMPO population projections have assumed a 1% growth rate, which is the average growth rate between Carson City, Douglas County, and Lyon County. Population data used in this chapter is available in a report, prepared October 1, 2014, titled Nevada County Age, Sex, Race, and Hispanic Origin Estimates and Projections 2000 to 2033. The report is available at the following web address: http://nvdemography.org.

Figure 4.1 CAMPO Population Projections to 2040 Chart (Nevada State Demographer)



Source: Nevada State Demographer, Nevada County Age, Sex, Race, and Hispanic Origin Estimates and Projections 2000 to 2033, 2035 and 2040 projections estimated by CAMPO staff

Figure 4.2 CAMPO Population Projections to 2040 Table (Nevada State Demographer)

	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040
Carson City	54,694	55,168	55,945	56,823	57,661	58,272	61,933	65,594	69,254	72,915
Douglas County	48,347	48,220	48,171	48,190	48,230	48,072	47,767	47,462	47,157	46,852
Lyon County	53,652	54,229	55,404	56,768	58,112	58,688	63,597	68,506	73,415	78,324
Metropolitan Planning Area	84,204	85,046	85,896	86,755	87,623	88,499	93,013	97,758	102,745	107,986

Source: Nevada State Demographer, Estimates and Projections 2000 to 2033

Seniors

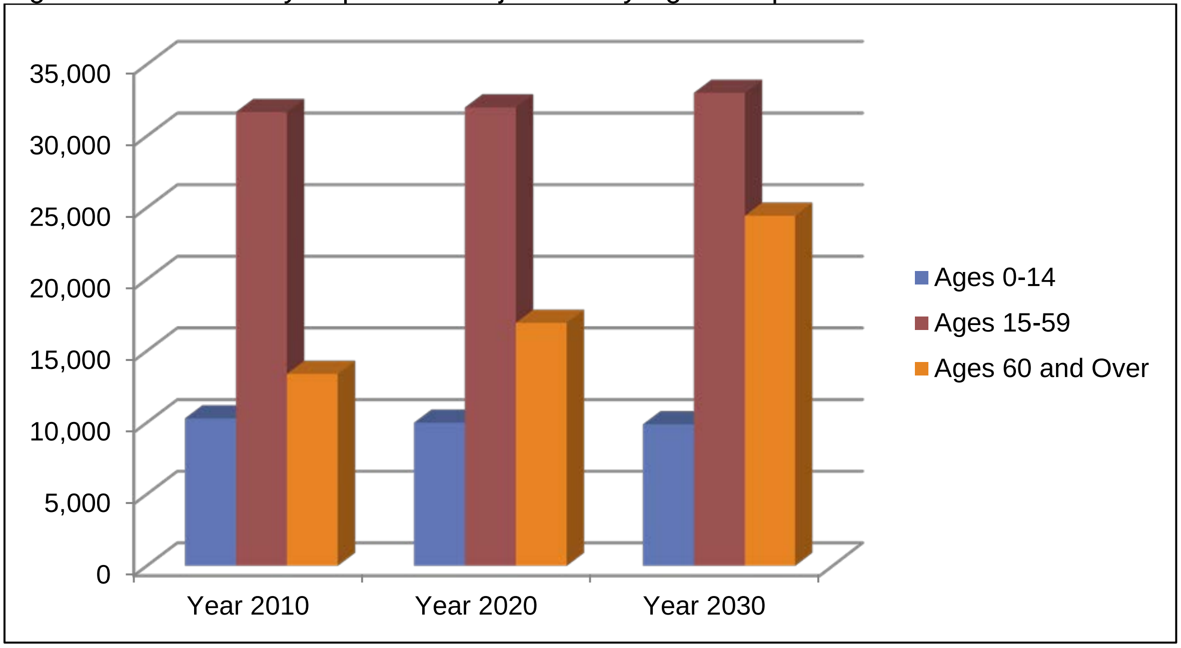
In the CAMPO area, seniors are anticipated to make up a larger percentage of the population than in the past. In Carson City, between 2010 and 2030, the population of people 60 years of age and older is anticipated to grow by 22%. In Douglas and Lyon Counties, this population cohort is anticipated to grow by, 36% and 62%, respectively.

Figure 4.3 Percentage of the Population 60 Years and Older

Member Agency	2010	2020	2030
Carson City	24%	29%	36%
Douglas County	30%	37%	39%
Lyon County	24%	27%	28%

This growing age group will necessitate changes to the transportation system to assist this age group in maintaining safe and independent mobility. The National Institute on Aging published an article in March of 2015, titled *Age Page: Older Drivers* (available link at: https://www.nia.nih.gov/health/publication/older-drivers), about safe driving for seniors. The article identified traits inherit to aging that have unsafe consequences to transportation system users. These traits are slower reaction time and reflexes, trouble hearing, dementia, and trouble seeing. Investment in safety measures that address these traits should be a priority.

Figure 4.4 Carson City Population Projections by Age Group



Land Use

Land use has a significant influence on transportation. The relationship between transportation and land use is complex, with current land use patterns influencing transportation patterns and transportation patterns influencing where people and businesses want to be located. This document does not propose any changes to existing land use, but aims to highlight how land use decisions influence the transportation network and ultimately the quality of life for Carson area citizens.

As member jurisdictions strive to increase transportation services with limited funds, the cost to maintain a growing network of roads, sidewalks, bike lanes, traffic signals, street lighting, and other amenities, continues to grow. Land use patterns that are less dense typically result in lower revenue and higher costs per square mile, making it difficult for local governments to maintain and enhance government services such as the transportation network. This commonly results in general funds being used to maintain and make necessary improvements to the transportation network. Less dense land use patterns also make other modes of transportation, such as mass transit, walking, and bicycling more difficult. However, dense land use patterns are not the answer to everything, nor would it appeal to everyone’s quality of life standard.

Due to the recent recession, the land use in the CAMPO area has experienced little change due to low development pressure. As Northern Nevada’s economy strengthens, so will development pressures. As elected and appointed officials deal with this development pressure, the following factors should be considered to help minimize the cost of aging infrastructure and a growing transportation network.

- Impact fee - An impact fee is a fee imposed by a local government on a new or proposed development project to pay for all or a portion of the costs of providing public services to new development. Use of impact fees must be justified and proportional to the impact of the development. For example, an impact fee for a one-bedroom apartment would be less than an impact fee for a 2,000 square foot home on a quarter acre. With respect to transportation, impact fees could help with funding capital projects through development of collector and arterial roads that can provide access to community and commercial uses.

- Transportation Network Connectivity – New projects should be designed to establish connectivity within the existing street network, developing connections to the existing roadways as well as pedestrian and bicycle facilities wherever possible. As new residential subdivisions continue to build curvilinear streets with subdivision walls, network connectivity will continue to be degraded. The curvilinear design typically involves traffic from many local roads funneling onto a wider road facility that encourages unsafe driver behavior, such as speeding. Additionally, this design results in congested traffic (bottlenecks) due to limited access to the surrounding road network. Improved connectivity allows for the distribution of traffic and builds resilience into the transportation network. Improved connectivity for pedestrians and bicycles creates opportunity for these modes of transportation by creating shorter distance to travel, allowing non-motorized users to access more businesses, schools, and community facilities.

Currently, multiple land use developments are taking place within the CAMPO area. The following projects are anticipated to be influential to future land use and transportation patterns:

The **Tahoe Reno Industrial Center (TRIC)**, located in Storey County, is a 107,000-acre business park that encompasses a developable 30,000-acre industrial complex with pre-approved industrial and manufacturing uses. Important to CAMPO is the growth created as this park develops. The Carson area transportation system will experience higher demand from this use once USA Parkway is constructed. Also known as State Route 439, USA Parkway will provide access from U.S. Highway 50 to the industrial park as well as connection to Interstate 80. This roadway connection is anticipated to be completed by December 2017.

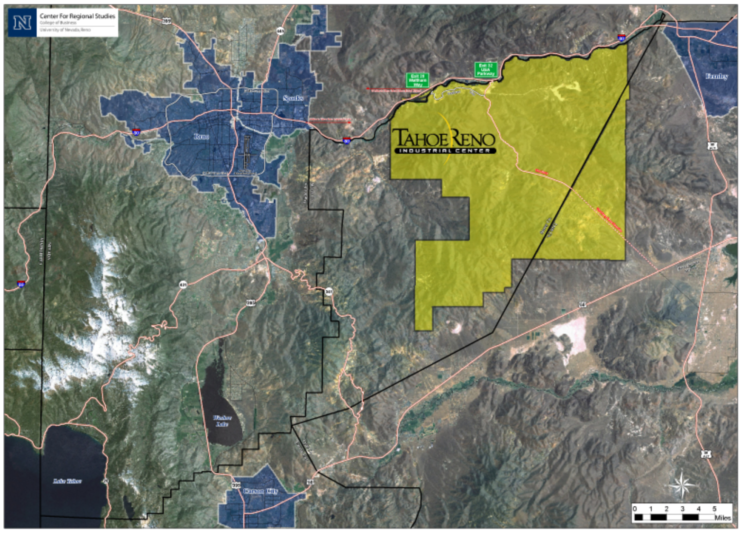


Figure 4.5 Map of TRIC

The **Carson City Freeway Extension** will add 2.9 miles of controlled access freeway from Fairview Drive to the signal at US 50/South Carson Street. The Freeway is designed for two lanes in each direction with provisions for future widening in the median. This project began in spring 2015. The construction duration is anticipated to last approximately 24 months (two construction seasons) and will consist of the following elements:

- A signalized intersection at US 50/South Carson Street
- Drainage facilities for roadway and offsite storm water runoff on the project, including drainage channels, a detention basin and box culverts
- Roadway earthwork and final grading from Fairview Drive Interchange to South Carson Street, including major excavation and embankment
- Roadway paving
- Landscaping
- Sound walls
- Signals, lighting, signing and pavement striping

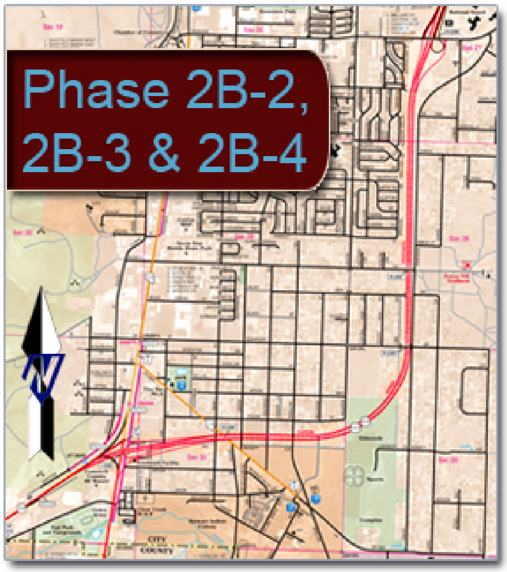


Figure 4.6 Carson City Freeway Extension

*More information available at NDOT's Projects and Program website: http://www.nevadadot.com/Projects_and_Programs/Road_Projects/

The **Schulz Ranch Residential Subdivision** is a recently approved project with 423 units. The subdivision is located in south Carson City, near Douglas County's northern edge. Primary access and traffic demand will be at Topsy Lane and U.S. 395, in Douglas County, and on Snyder Avenue off of Bigelow Drive or Center Drive in Carson City.

The Lompa Ranch North Specific Plan that includes development plans for 251 acres for a mix of commercial and residential uses. The project is anticipated to have approximately 2,500 single-family and multi-family units and 300,000 square feet of commercial. This project will exert demand on the transportation network at numerous locations.

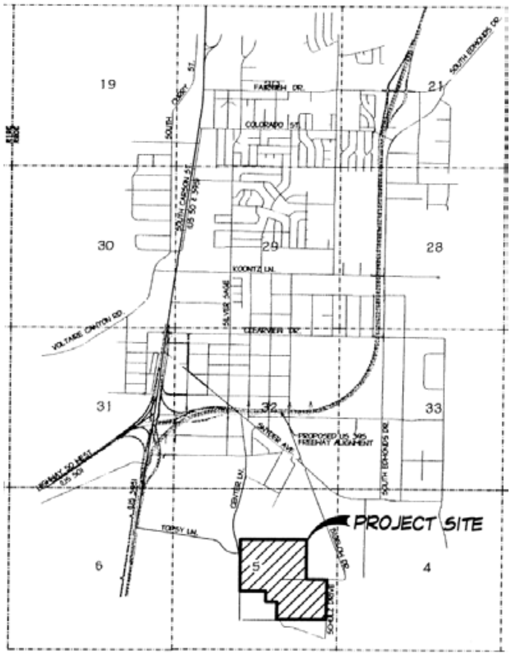


Figure 4.7 Schulz Ranch Residential

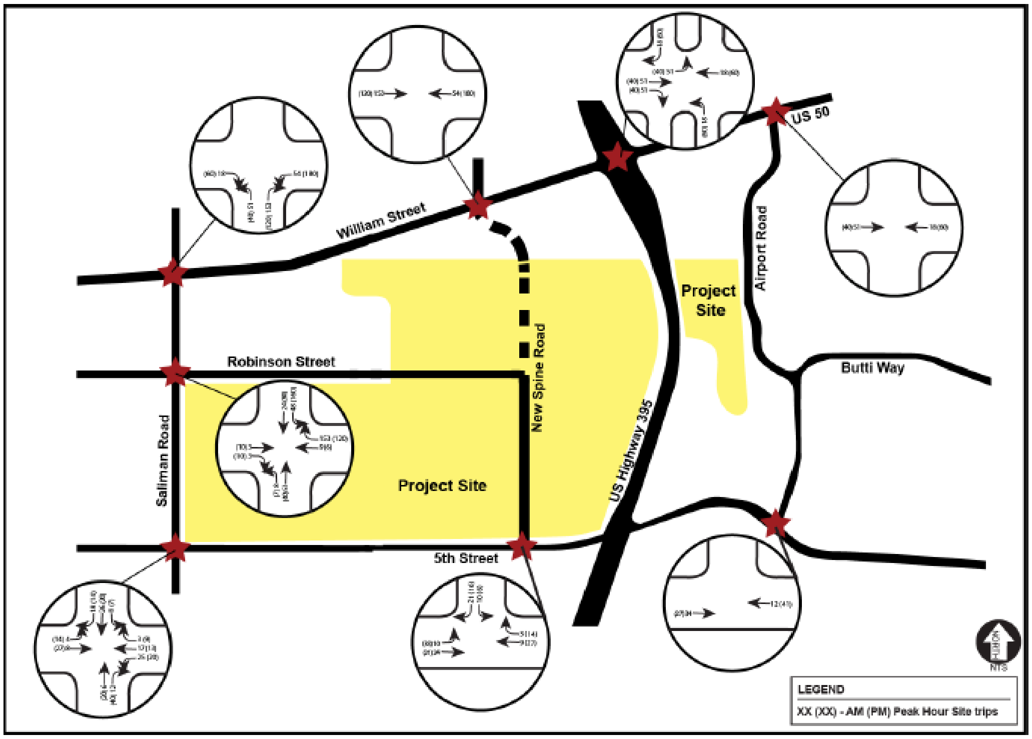


Figure 4.8 Lompa Ranch North Specific Plan Subdivision

Freight

The Carson area transportation system is responsible for the movement of goods in and through the region. Due to the absence of other transportation modes, truck traffic carries all of the freight in the Carson area. An effective transportation system provides for the efficient, reliable, and safe movement of truck traffic. While the amount of truck traffic in this region is small compared to larger metropolitan areas, truck traffic is responsible for a fair portion of the overall traffic, reaching 20% on major highways.

Freight traffic supports the Carson area regional economy in two notable ways. First, it provides time sensitive and non-time sensitive goods to local business and individual consumers, allowing for businesses to operate and individuals to shop without the burden of driving. Freight traffic associated with shopping from home is anticipated to grow in coming years. In a recent study by the U.S. Department of Transportation, freight volumes in the United States are anticipated to increase by 45 percent. The study noted increases in online shopping, and how home package deliveries are becoming a factor in congestion on local roads and highways.

The second way freight traffic supports the Carson area regional economy is by providing services, products, and accommodations to freight carriers. This economic benefit is highlighted in a statewide freight plan sponsored by the Nevada Department of Transportation (NDOT). This freight plan is in development and anticipated to be complete in the summer of 2016. Information on the development of this plan is available online at the following web address: http://www.nevadafreightplan.com/

In the CAMPO area, the travel demand model shows a low level of service for two fright corridors. These corridors are U.S. Highway 50 east of the Carson City Freeway and on U.S. Highway 395, south of the Carson City Freeway. Both corridors are noted in the State's freight plan as bottlenecks for freight traffic traveling on the CAMPO transportation network. At this time, with unknown demand from the Tahoe Regional Industrial Center east of CAMPO and unknown travel patterns resulting from the completion of the Carson City Freeway, CAMPO has recommended future corridor studies in anticipation of congestion at these existing bottlenecks. The following freight studies and project have been recommended to the NDOT:

- Capacity and Operations Corridor Study for U.S. Highway 395 - Johnson Lane to U.S. Highway 50 and I-580 intersection

- Capacity and Operations Corridor Study for U.S. Highway 50, between I-580 to CAMPO boundary

- I-580/U.S. Highway 395 interchange improvement – completion of the Freeway Phase 2B-4

Streets and Highways

The CAMPO road network is comprised of 505 lane miles of roadway with an estimated 571 million annual vehicle miles of travel (VMT) in 2014. Since 2010, the number of VMTs has increased by 25 percent and is projected to increase another 13 percent by 2025 and 27 percent by 2040, based on 2014 VMTs. As the age and usage of the road network increases, so does the need for investment. This section of the regional transportation plan includes data and analysis that can be used to help prioritize roadway investment. Included in this data are results from a travel demand model that CAMPO uses to forecast roadway usage and to identify congested areas of the network.

Travel Demand Model

Travel demand modeling is a type of software used as a tool to estimate future transportation demand. The modeling takes into account future population, economic forecasts and other variables, including land use patterns and estimates of future activity from local governments. Since the last Regional Transportation Plan in 2012, the CAMPO model has been updated with new traffic counts, including counts from the Nevada Department of Transportation and AirSage data. AirSage data is anonymous wireless signaling data used to improve travel demand modeling. Additional updates to the model include 2014 Nevada State Demographer population and employment estimates, including major employment developments such as the Tahoe Regional Industrial Center.

The model provides data for a baseline year of 2015 and forecasted data for years 2025 and 2040. For the forecasted years, the model assumes certain transportation projects are constructed and produces scenarios of how the proposed improvements, along with the forecasted growth influences traffic conditions. The model provides two types of measures for analysis, a level of service (LOS) and travel time estimates. The LOS measure, which is a long-standing performance measure, can be used to evaluate roadway sections and intersections. The second measure, travel time estimates, also known as travel time reliability, measures traffic delay due to congestion by determining the time is takes to travel from one location to another. Travel time reliability is significant to many transportation system users, whether they are vehicle drivers, transit riders, or freight shippers. Personal and business travelers value reliability because it allows them to make better use of their own time. Shippers and freight carriers require predictable travel times to remain competitive.

*The following pages include results from CAMPO's travel demand model. A complete report is provided here: **http://carson.org/home/showdocument?id=50163** for reference.

Figure 4.9 Travel Times between CAMPO's Transportation Gateways

Travel Times in Minutes between Metropolitan Planning Area Gateways		**Year 2015**	
From	**To**	**AM**	**PM**
U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	U.S. Hwy 50 East (Near Chaves Road)	30.2	39.4
	U.S. Hwy 395 South (2000 feet south of Johnson Lane)	23.1	30.4
	U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	16.8	18.7
U.S. Hwy 50 East (Near Chaves Road)	U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	35	33.6
	U.S. Hwy 395 South (2000 feet south of Johnson Lane)	48.2	53.6
	U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	41.9	41.9
U.S. Hwy 395 South (2000 feet south of Johnson Lane)	U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	26.4	26.4
	U.S. Hwy 50 East (Near Chaves Road)	46.6	55.2
	U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	16.1	15.3
U.S. Hwy 50 West (2.7 miles west of U.S. Hwy 395)	U.S. Hwy 395 North (Carson City and Washoe County Line near Hobart Road)	17.3	18.5
	U.S. Hwy 50 East (Near Chaves Road)	37.5	47.3
	U.S. Hwy 395 South (2000 feet south of Johnson Lane)	13.3	19.1

In compliance with new federal regulations for performance based planning, the following objectives and performance measures have been incorporated into this plan. Figure 4.9 along with additional travel times provided within the travel demand model (available link at: http://carson.org/home/showdocument?id=50163), would be used to evaluate progress towards meeting the objectives below.

Objective: Maintain or improve travel times

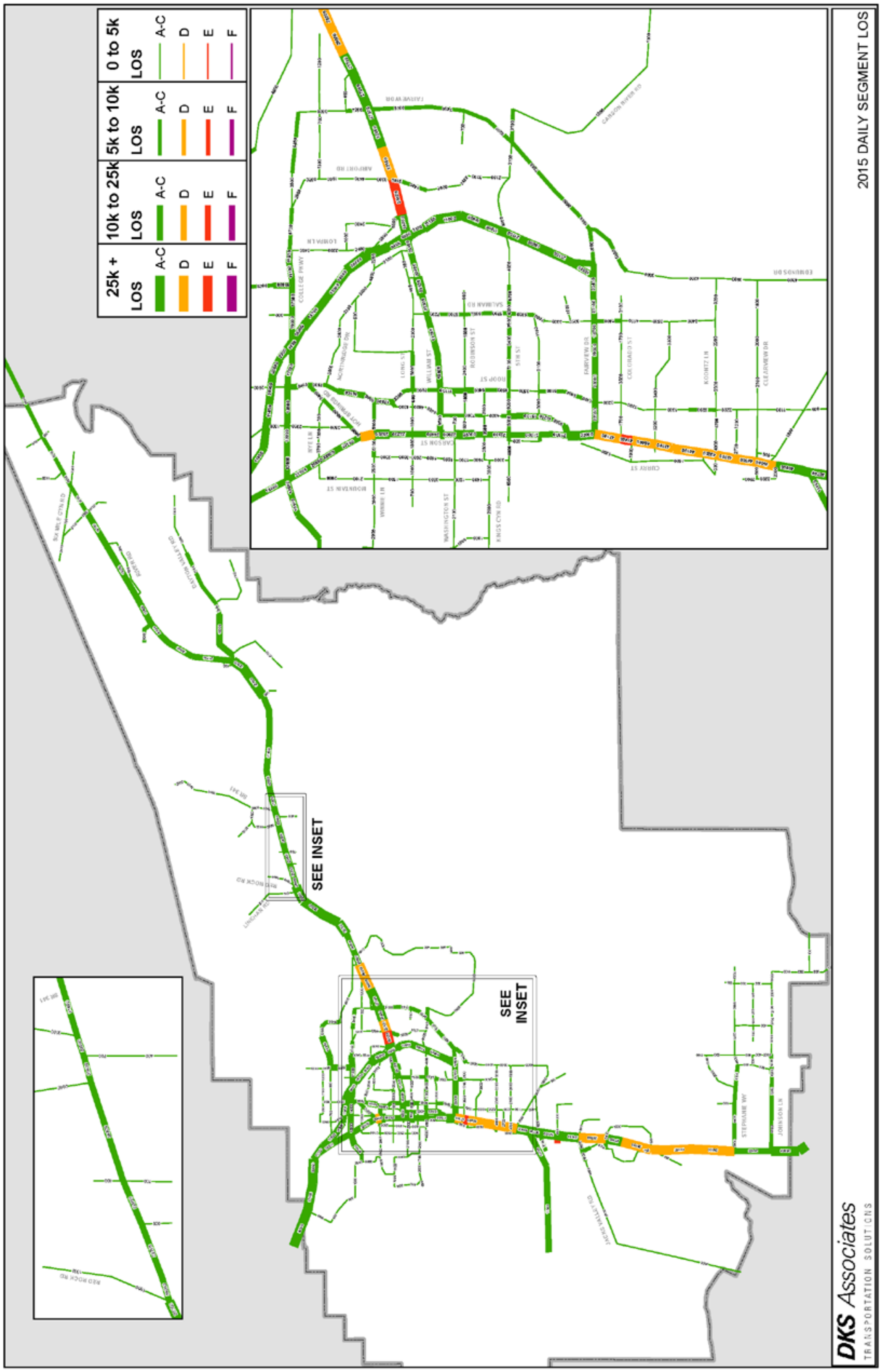
Objective: Improve travel times on major truck routes during peak hours

Figures 4.11, 4.12, and 4.13 on the following pages graphically show the level of service for the years 2015, 2025, and 2040. Figure 4.11 shows existing conditions, Figure 4.12 and 4.13 show conditions in the 2025 and 2040 with the 10 financially feasible transportation projects noted in Chapter 3. The list of projects is duplicated below for quick reference.

Figure 4.10 Proposed Transportation Projects in the Fiscally Constrained Financial Plan

Proposed Projects in the Fiscally Constrained Plan					
Agency	**Project Description**	**Project Limits**	**Improvements**	**2025**	**2040**
NDOT	Carson City Freeway Extension	Fairview Drive to Spooner Junction	Construct 4-lane freeway	X	X
CC	Curry Street Improvement	Rhodes Street to Lake Glen Drive	Improved 2-lane roadway	X	X
CC	Roop Street Widening	Washington Street to Fifth Street	Widen to 4 lanes	X	X
CC	Saliman Road Widening	Fairview Drive to Colorado Street	Widen to 4 lanes	X	X
CC	Carson Street Road Diet	E William Street to E Fifth Street	Reduce to one lane per direction	X	X
CC	William Street Corridor Road Diet	Carson Street to Saliman Road	Reduce to one lane per direction	X	X
CC	N. Carson Street Corridor Improvements	William Street to N. Freeway Interchange	Corridor Improvements	X	X
CC	S. Carson Street Corridor Improvements	Fifth Street to S. Freeway Interchange	Reduce to two lanes per direction	X	X
NDOT	Full Interchange @ Spooner Jct	CC Freeway at US 395/US 50 W	Construct full interchange		X
LC	New Bridge Over Carson River	Dayton Valley Road to Chaves Road	Construct bridge over Carson River to connect Dayton Valley Rd to Chaves Rd		X

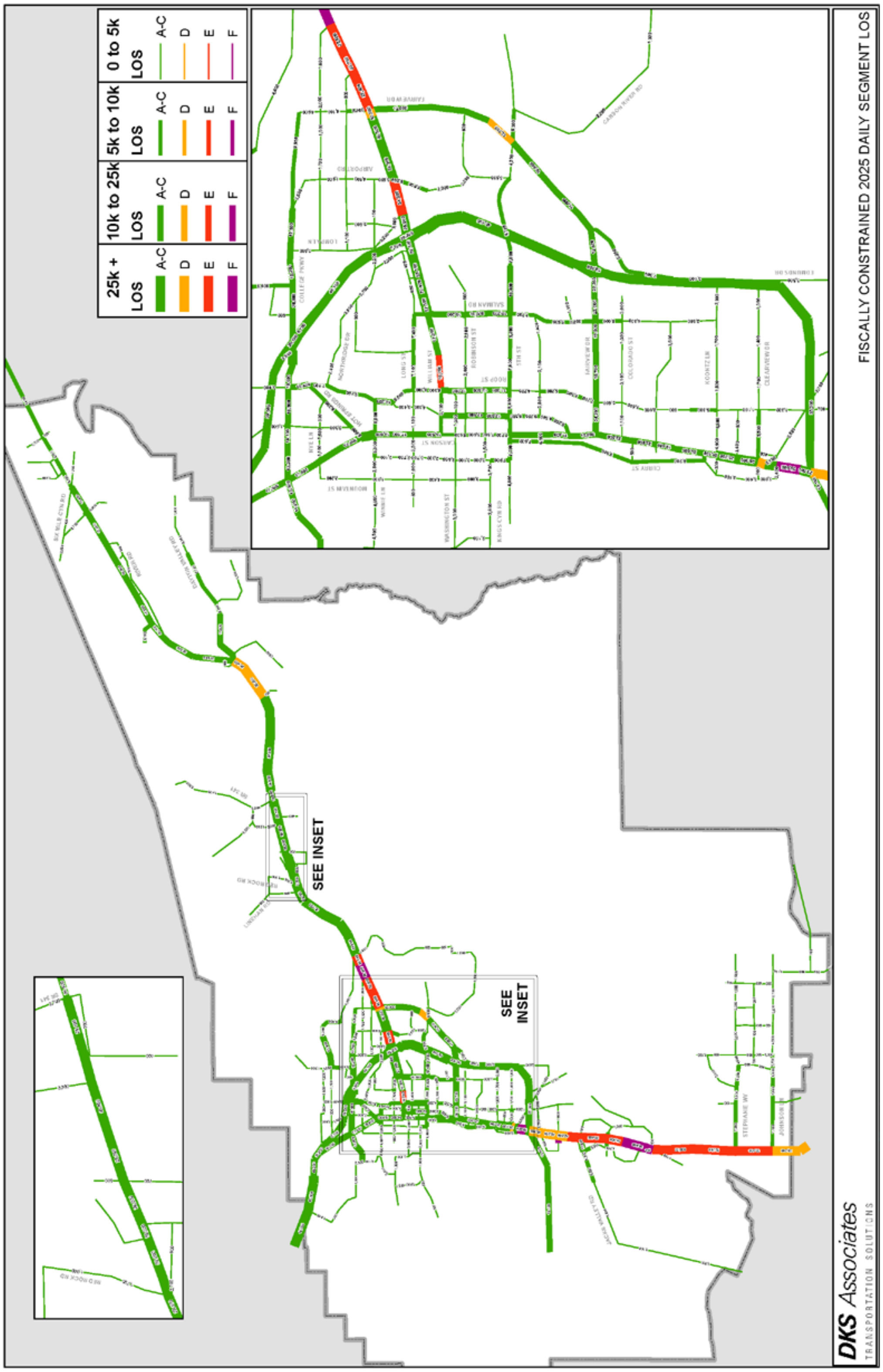
Figure 4.11 Existing 2015 Travel Demand Model Condition



Level of Service (LOS)

(A) Free Flow Traffic (B) Steady Traffic (C) Steady Traffic but Limited
(D) Steady Traffic at High Density (E) Traffic at Saturation, (F) Congestion

Figure 4.12 Projected 2025 Travel Demand Model Condition

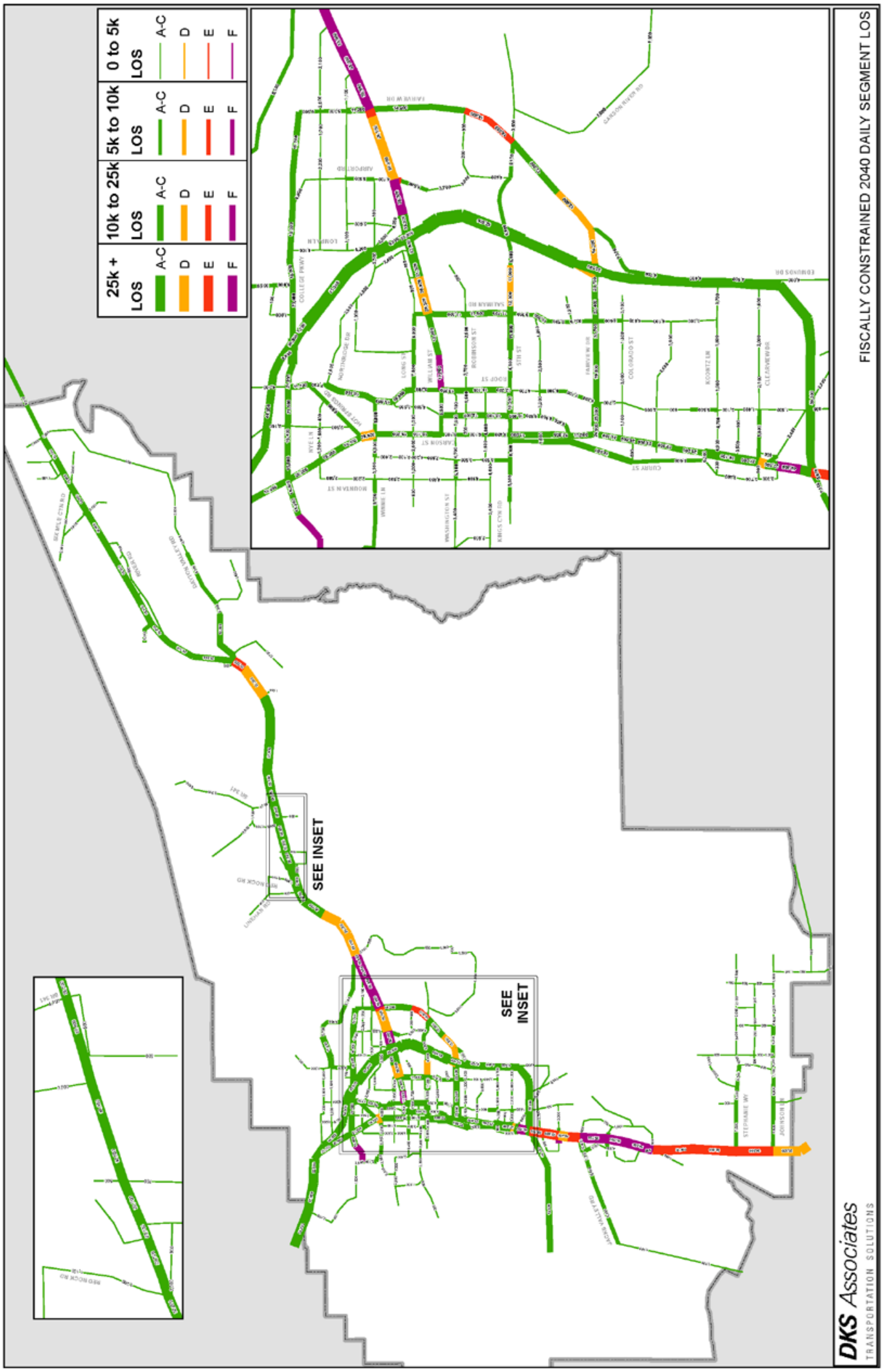


Level of Service (LOS)

(A) Free Flow Traffic (B) Steady Traffic (C) Steady Traffic but Limited

(D) Steady Traffic at High Density (E) Traffic at Saturation, (F) Congestion

Figure 4.13 Projected 2040 Travel Demand Model Condition



Level of Service (LOS)

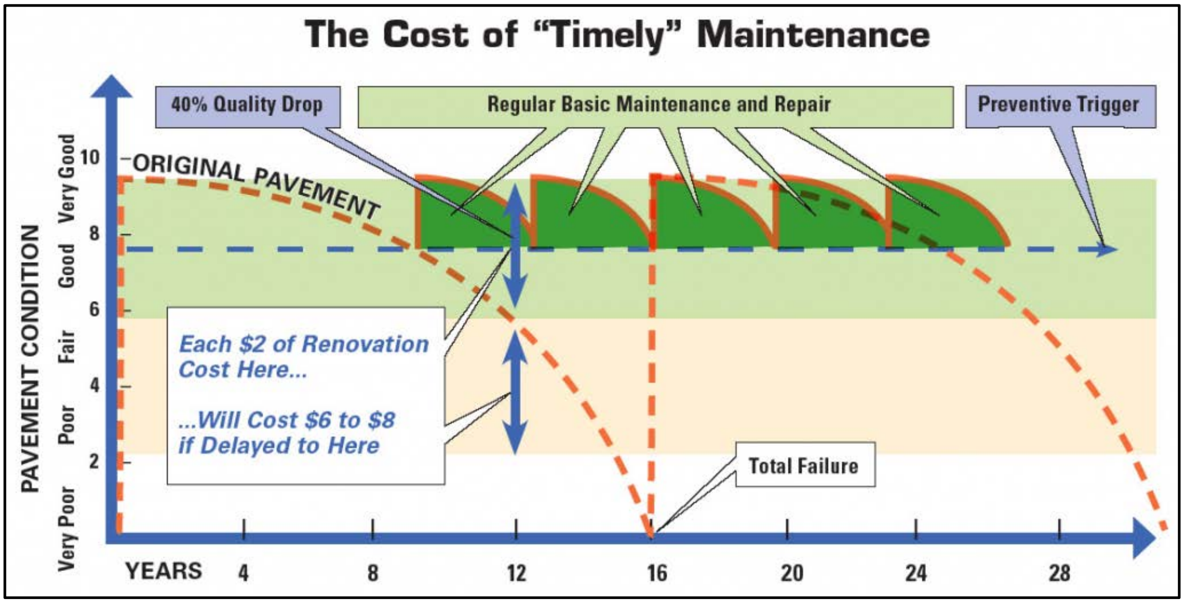
(A) Free Flow Traffic (B) Steady Traffic (C) Steady Traffic but Limited
(D) Steady Traffic at High Density (E) Traffic at Saturation, (F) Congestion

Pavement Management System

A Pavement Management System (PMS) is a planning and operations tool used to help prioritize and time roadway investment, such as preventative maintenance and renovation to roadways. A PMS collects, stores, organizes, and analyzes pavement condition information. It is far less expensive to maintain a road in good condition than to allow a road to deteriorate before repairing it (refer to Figure 4.14). Pavement Management places priority on maintaining good condition roads, which over the long-term will effectively provide a higher condition roadway at a lower cost.

Safety issues associated with roadway deterioration as well as the need to reconstruct certain roadways to current standards make it difficult for agencies to commit 100% to this strategy.

Figure 4.14 Graphic Example of Pavement Management Strategy



Each of the CAMPO member agencies have individual pavement management programs. Carson City and Douglas County are in the process of refining their existing management systems. Lyon County is in the process of developing a pavement management system and has contracted with a consultant to collect pavement data. Each agency measures the health of their roadways with a scale known as the Pavement Condition Index (PCI), which is a numerical value between 0 and 100, 100 representing the best possible condition. The number and types of distresses in a particular section of pavement determine the PCI value.

The Nevada Department of Transportation (NDOT) maintains pavement data on all Federal-aid eligible roads in the state; this includes interstate highways, State Routes, and sample data on selected arterials and collectors within the CAMPO area. As a federal requirement, the NDOT uses the International Roughness Index (IRI), which measures the "roughness" of the roadway surface. The International Roughness Index and Pavement Condition Index are similar but cannot be converted from one scale to another. The IRI was chosen as a performance measure, through transportation legislation, as a pavement condition indicator for the National Highway Performance Program (NHPP). NDOT's collection of IRI conditions within CAMPO area will satisfy federal IRI requirements for CAMPO.

Active Transportation

No transportation system is complete without Active Transportation. Active Transportation is any self-propelled, human-powered mode of transportation, such as walking or bicycling. An effective active transportation network should be user friendly and efficient. A utilized active transportation system can benefit the local economy, offer healthier lifestyles, and raise the region's quality of life.

As elected officials are forced to prioritize expenses, improvements for active transportation are often placed at the bottom. However, jurisdictions throughout the country are finding success in adding active transportation improvements by pairing pedestrian and bicycle improvements with routine maintenance projects as well as larger roadway improvement projects. The success lies with implementing small design changes to existing roadways to improve conditions. As the Carson area's senior population grows, active transportation improvements will be critical to allow for aging in place. This involves designing the built environment to be usable to the greatest extent possible by all people, regardless of special needs or age. Walkable communities are places where people can easily and safely walk to access goods, services and local amenities. They are places with a variety of transportation options and where pedestrian activity is encouraged.

Streets are a vital part of livable, attractive communities. Everyone, regardless of age, ability, income, race, or ethnicity, ought to have safe, comfortable, and convenient access to community destinations and public places–whether walking, driving, bicycling, or taking public transportation. However, many of our streets are designed only for cars. A nationwide movement launched by the National Complete Streets Coalition in 2004, Complete Streets integrates people and places in the planning, design, construction, operation, and maintenance of our transportation networks. Complete Streets promote the development and implementation of policies, professional practices to ensure streets are safe for people of all ages, and abilities, balance the needs of different transportation modes, and support local land uses, economies, cultures, and the natural environment.

In 2015, CAMPO produced an ADA Transition Plan for transportation facilities. The plan evaluated 26 signalized intersections, approximately 30 miles of sidewalk, and 41 transit stops. The plan prioritizes the intersections, sidewalk areas, and the transit stops on a 13 point scale, identifying high and low priority issues.

All three of CAMPO's member agencies have made progress in planning for bicycle users. In 2014, Douglas County, with efforts sponsored by the Nevada Department of Transportation (NDOT), adopted a countywide bicycle plan that identifies a bike network. Lyon County, with efforts from NDOT, has drafted a countywide bike plan and is nearing completion. In 2014, the League of American Bicyclists recognized Carson City with a bronze level Bike Friendly Community (BFC) award, joining more than 325 visionary communities from across the country. Bike network maps for all three of the member agencies are included in this document.

Complete Streets

The term Complete Streets refer to how streets are designed and operate to enable safe access and comfortable accommodation for all users of all ages and abilities; including pedestrians, bicyclists, transit riders, and motorists of all types. As supported in an article by Smart Growth America, Complete Streets support economic development and enhance the visual experience for users.

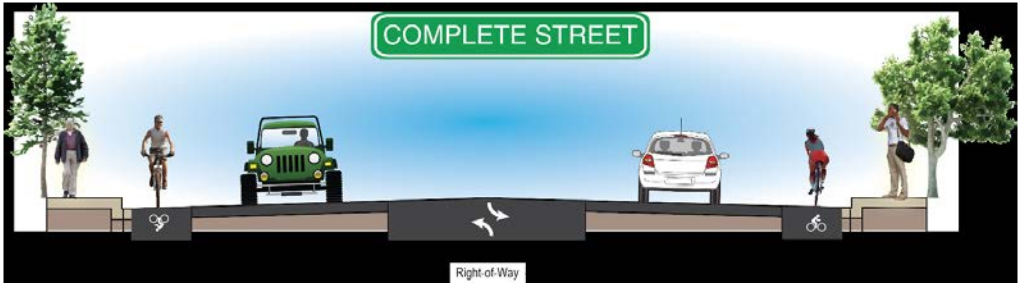
This article is included here: http://www.smartgrowthamerica.org/documents/cs/factsheets/cs-economic.pdf for reference.

In addition to accommodating motorists on the roadway, a Complete Streets design focuses on the needs of travelers outside that group, including younger or older people, those with disabilities, and those who travel by transit, bicycle, or on foot, and who have oftentimes been overlooked in the transportation planning process. Many areas in the Carson area lack safe places to walk or bicycle. Access to key community resources such as parks, shops, grocery stores, and schools, is often limited to automobile traffic.

The Complete Streets design is about safety and efficiency. Nationwide, people are injured or killed each year while walking or bicycling, and oftentimes the built environment is a contributing factor. Though the Carson area has historically had few accidents involving pedestrians and bicyclists, they have occurred. A goal of this plan is to increase the safety of all modes on the transportation system.

The Complete Streets design seeks to develop an integrated and connected network of streets that are safe and accessible for all people. This design makes active transportation such as walking and bicycling more convenient; provides increased access to employment centers, commerce, and educational institutions; and allows more options in traveling so transportation is less of a financial burden. These noted benefits are found to improve the quality of life in communities.

Figure 4.15 Graphic Example of a Complete Street Design Treatment



Source: The National Complete Streets Coalition – www.CompleteStreets.org

Existing conditions and future plans should be taken into consideration when evaluating a roadway for Complete Streets treatments. There are varying types of treatments that can accommodate a community's need and in some cases, a particular road treatment may not be necessary. For example, a wide shoulder may be more appropriate than a bike lane on a rural road or if there are no land uses that generate pedestrian traffic then a sidewalk may not be an appropriate treatment.

Americans with Disabilities Act (ADA)

The ADA is a civil rights law that mandates equal opportunity for individuals with disabilities. The ADA prohibits discrimination in access to jobs, public accommodations, government services, public transportation, and telecommunications. ADA requires all Programs, Services and Activities (PSAs) of public entities to provide equal access for individuals with disabilities. The Act applies to all facilities, including facilities built before and after 1990.

An objective of this plan is to increase the number of ADA compliant transportation facilities. Efforts toward achieving this objective will be measured by tracking the number of transportation facilities improved to ADA standards within the CAMPO boundary by jurisdiction.

Governmental agencies with 50 plus employees are required to perform self-evaluations of their current facilities (and infrastructure) regarding ADA access requirements. The agencies are then required to develop an ADA Transition Plan to address deficiencies. Plans are intended to achieve the following:

1. A list of obstacles to ADA compliance and the procedure for removing and/or accommodating these obstacles
2. A list of structural modifications that are needed
3. The timeline when these changes will be accomplished
4. Estimated costs of each change outlined in the plan
5. Identify the public officials responsible for implementation of the Transition Plan

In line with an objective from CAMPO's previous regional transportation plan, completed in 2015, Carson City conducted a comprehensive evaluation of its transportation related policies, programs, and a portion of their facilities along public rights-of-way to determine the extent to which individuals with disabilities may be restricted in their access to transportation facilities within Carson City. The self evaluation evaluated 26 signalized intersections, approximately 30 miles of sidewalk, and 41 transit stops. The plan prioritizes the intersections, sidewalk areas, and the transit stops on a 13 point scale, identifying high and low priority issues.

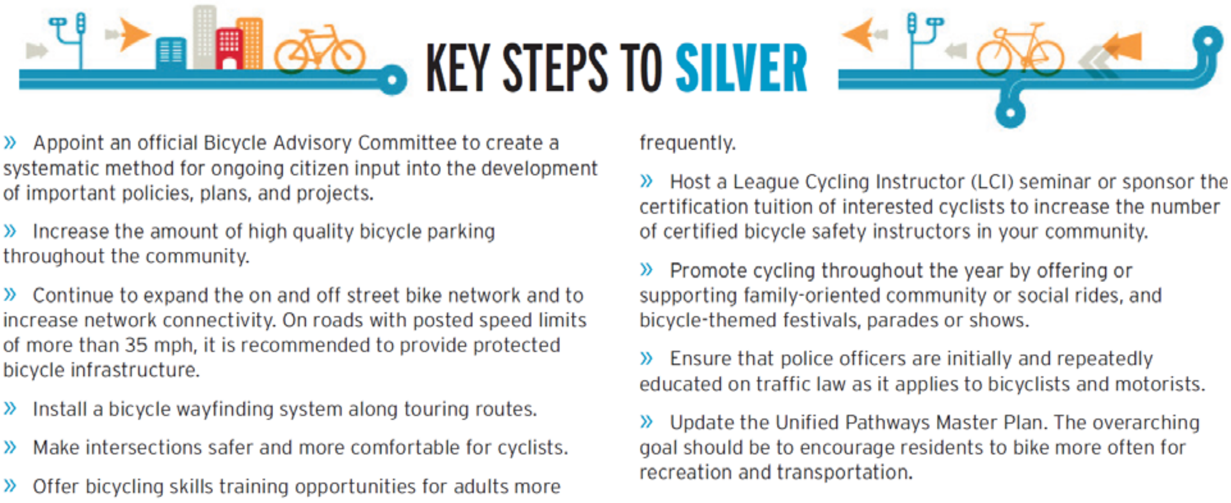
* The Carson City Transition Plan is available at the internet address below:
http://www.carson.org/modules/showdocument.aspx?documentid=44923

Bicycle Friendly Designation

In November 2014, the League of American Bicyclists recognized Carson City with a Bronze level Bicycle Friendly Community (BFC) award, joining more than 325 visionary communities from across the country. With the announcement, Carson City joins a leading group of communities, in all 50 states, that are transforming neighborhoods.

The BFC program helps communities evaluate quality of life, sustainability and transportation networks, while creating benchmarks to evaluate progress toward improving bicycle-friendliness. The Bronze level BFC award recognizes Carson City's commitment to improving conditions for bicycling through investment in bicycling promotion, education programs, infrastructure and pro-bicycling policies.

Provided with this award is a one page report card that rates Carson City on the 10 building blocks of a bicycle friendly community and outlines the steps needed to progress from a bronze to a silver award. The full report is included here:
http://carson.org/home/showdocument?id=50165.



KEY STEPS TO SILVER

» Appoint an official Bicycle Advisory Committee to create a systematic method for ongoing citizen input into the development of important policies, plans, and projects.

» Increase the amount of high quality bicycle parking throughout the community.

» Continue to expand the on and off street bike network and to increase network connectivity. On roads with posted speed limits of more than 35 mph, it is recommended to provide protected bicycle infrastructure.

» Install a bicycle wayfinding system along touring routes.

» Make intersections safer and more comfortable for cyclists.

» Offer bicycling skills training opportunities for adults more frequently.

» Host a League Cycling Instructor (LCI) seminar or sponsor the certification tuition of interested cyclists to increase the number of certified bicycle safety instructors in your community.

» Promote cycling throughout the year by offering or supporting family-oriented community or social rides, and bicycle-themed festivals, parades or shows.

» Ensure that police officers are initially and repeatedly educated on traffic law as it applies to bicyclists and motorists.

» Update the Unified Pathways Master Plan. The overarching goal should be to encourage residents to bike more often for recreation and transportation.

Bicycle Plans

As a result of communities throughout Nevada steadily expanding their support for bicycling over the last few decades, NDOT formalized this growing support in the Nevada Statewide Bicycle Plan, completed in 2013.

The first strategy listed within the State Bicycle Plan is for NDOT to assist local jurisdictions with adopting local bicycle plans that are endorsed by the Nevada Bicycle and Pedestrian Advisory Board (NBPAB). In support of this strategy, NDOT financially sponsored and assisted in the development of bicycle plans outside of the State's four Metropolitan Planning Organizations (MPOs). This included bicycle plans for Douglas County and Lyon County. The Carson Area Metropolitan Planning Organization has incorporated these planning efforts in areas of overlap.

* The Nevada Statewide Bicycle Plan, Douglas County Bicycle Plan, and when adopted, the Lyon County Bicycle Plan are available at the following internet address:
http://www.nevadadot.com/About_NDOT/NDOT_Divisions/Planning/BikePed/Bicycle_Plans.aspx.

Planning maps of the bike networks, within the CAMPO planning area, for all three of the member agencies are provided for reference on the following pages, a list of the maps is provided below.

Bike Network Planning Maps

- Carson City Bike Facility Map (shows existing and proposed bike facilities)
    - Figure 4.16 – Northeast Carson City Bike Facility Map
    - Figure 4.17 – Southeast Carson City Bike Facility Map
    - Figure 4.18 – Southwest Carson City Bike Facility Map
    - Figure 4.19 – Northwest Carson City Bike Facility Map
- Carson City Bike Route Map (shows existing and proposed bike routes)
    - Figure 4.20 - Northeast
    - Figure 4.21 - Southeast
    - Figure 4.22 - Southwest
    - Figure 4.23 - Northwest
- Figure 4.24 - Douglas County Proposed Bike Network
- Figure 4.25 - Lyon County Proposed Bike Network

Figure 4.16 – Northeast Carson City Bike Facility Map

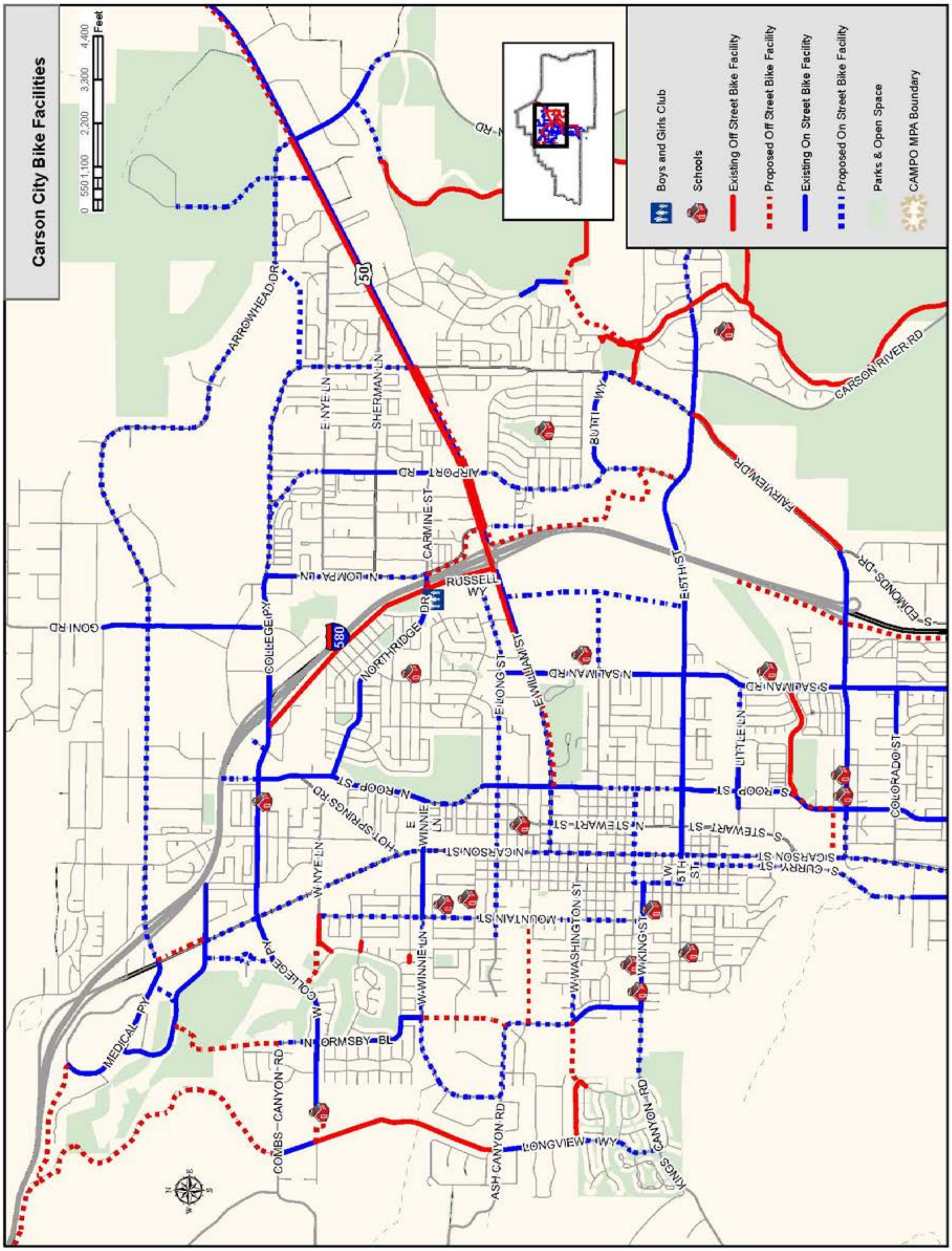


Figure 4.17 – Southeast Carson City Bike Facility Map

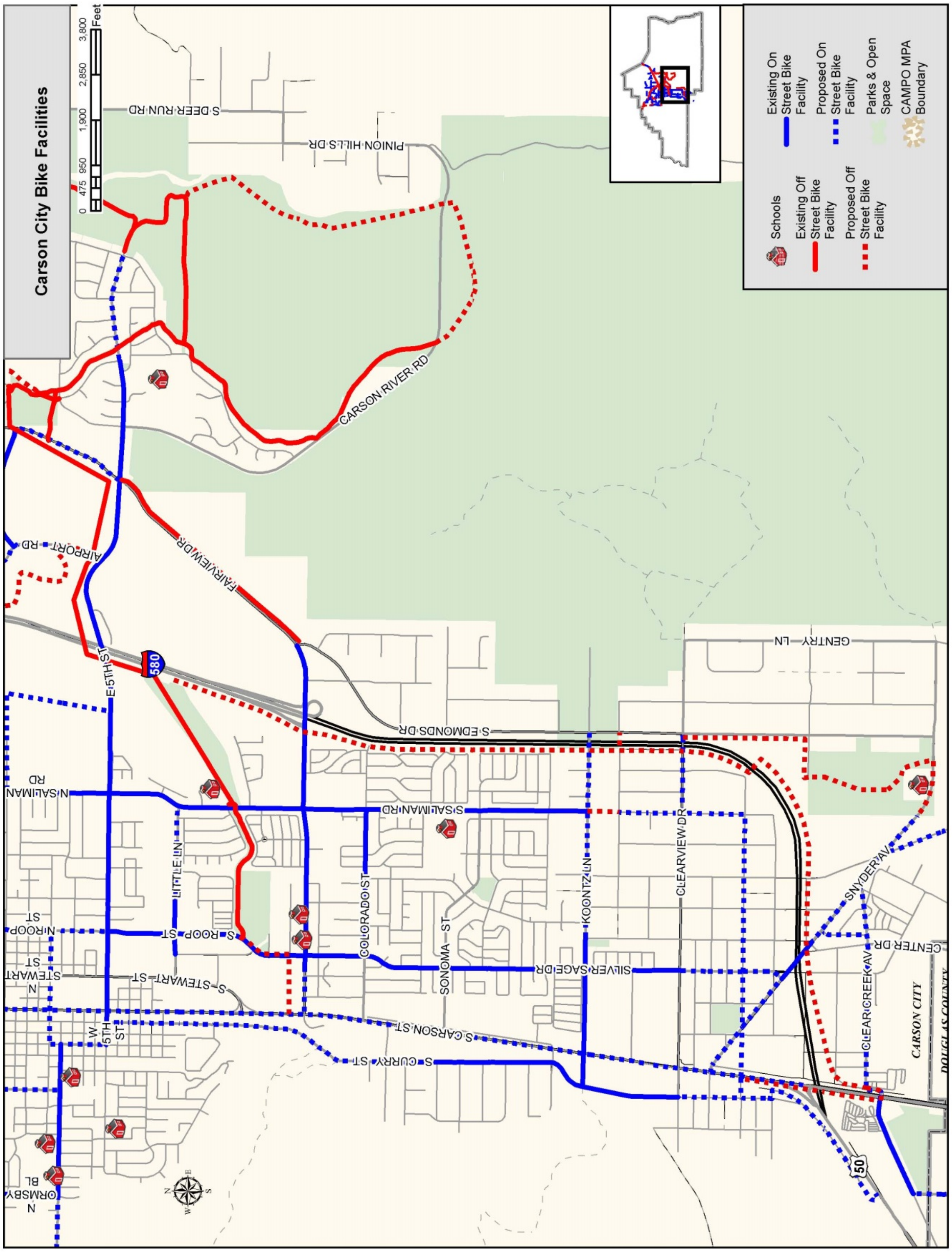


Figure 4.18 – Southwest Carson City Bike Facility Map

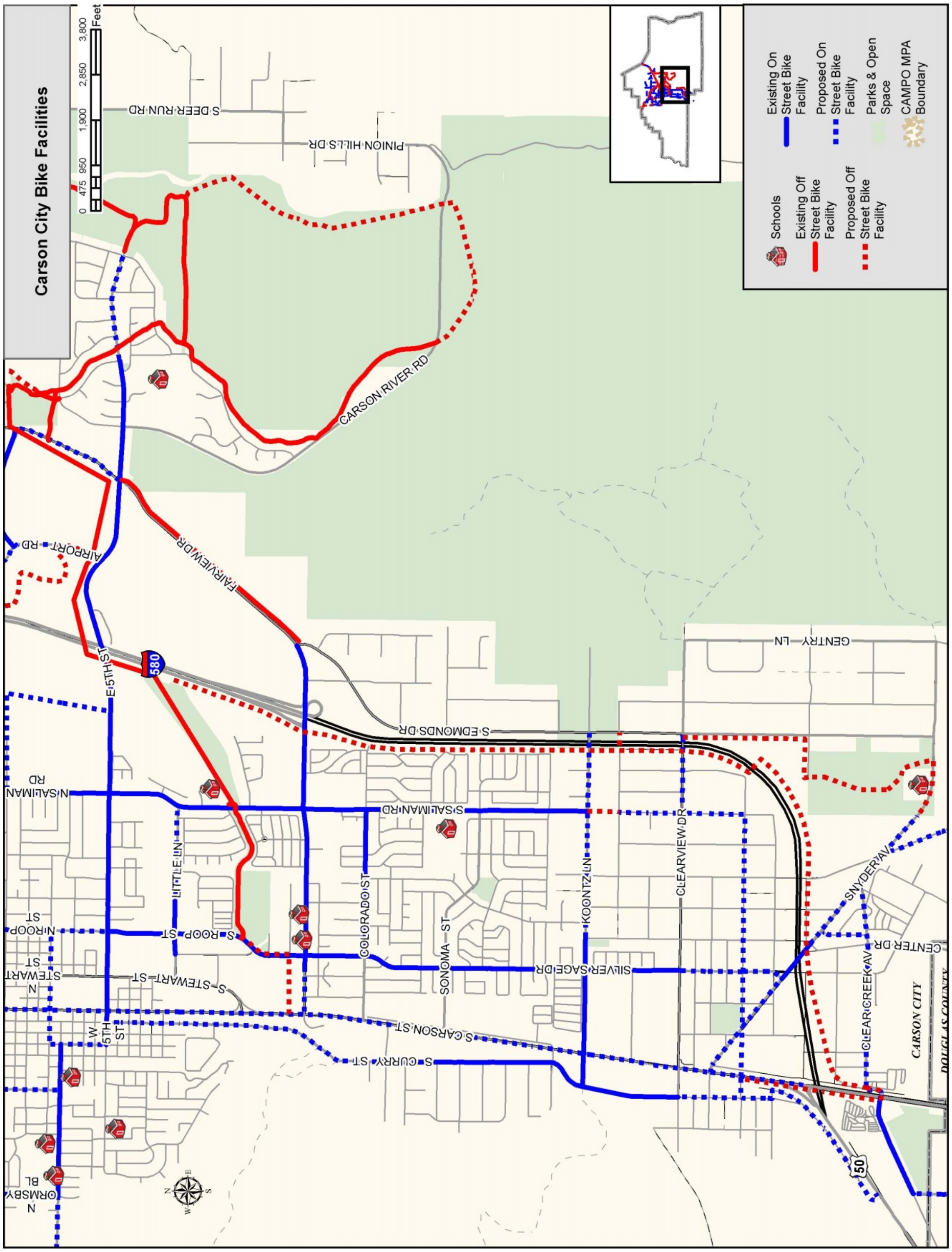


Figure 4.19 – Northwest Carson City Bike Facility Map

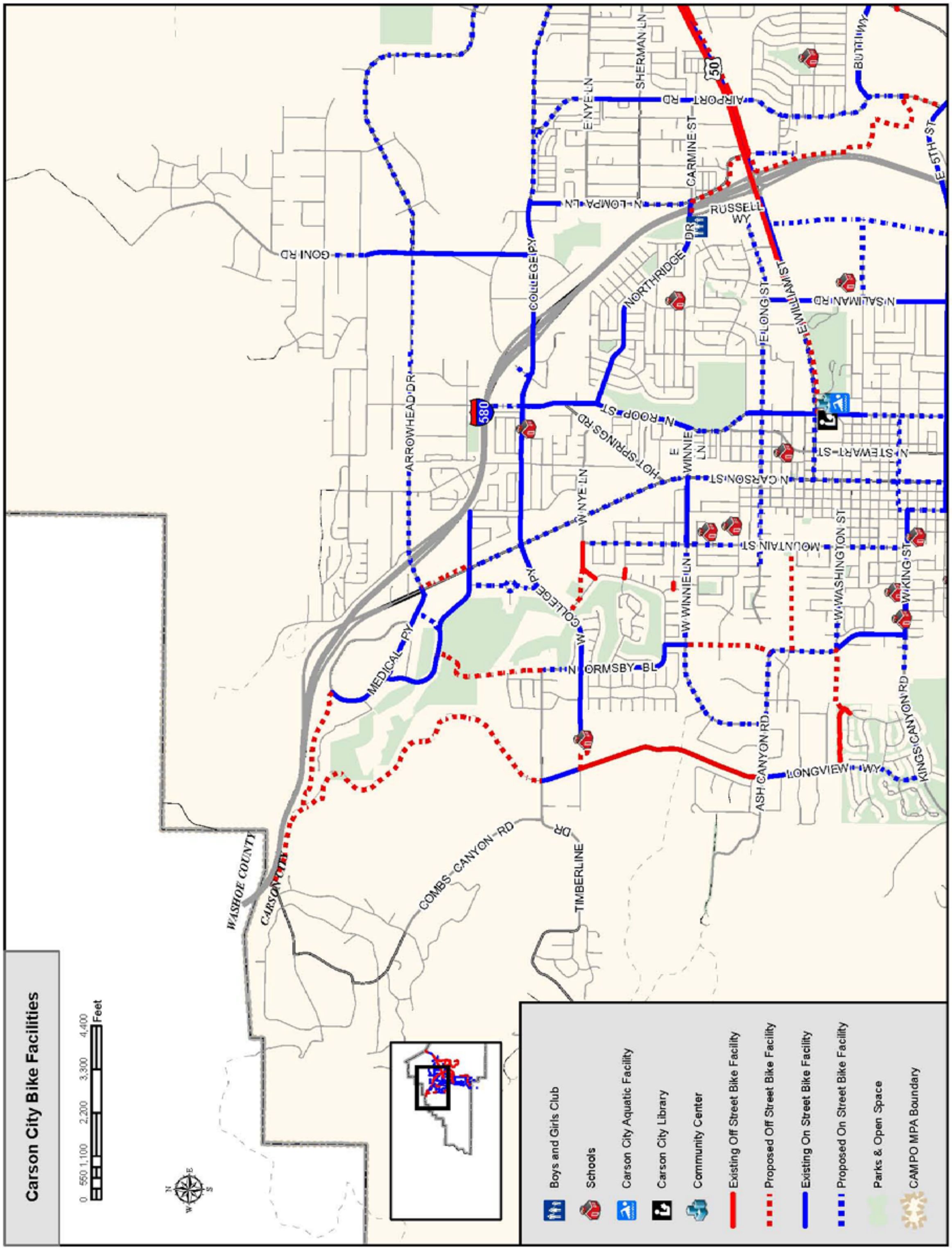


Figure 4.20 Northeast Carson City Bike Route Map

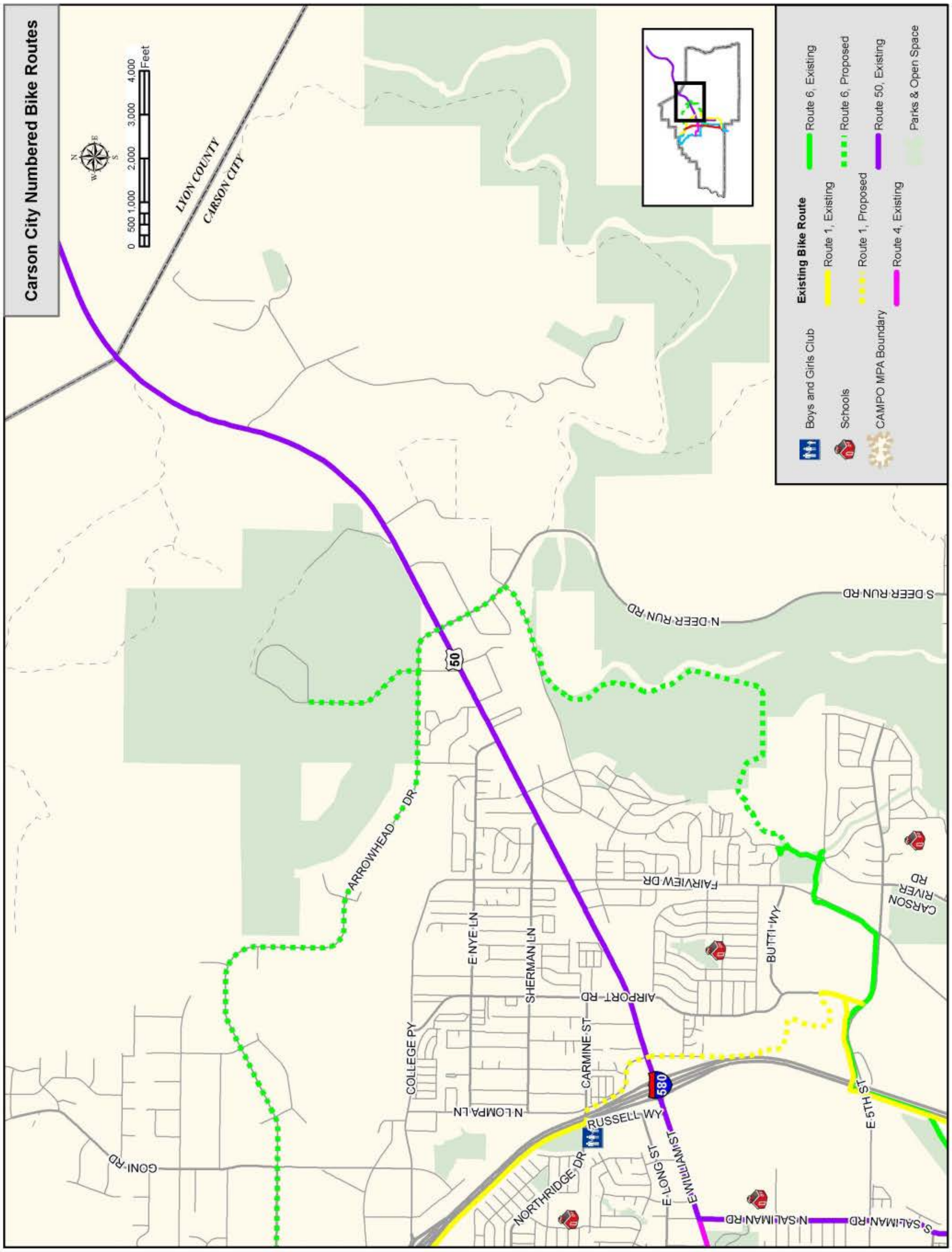


Figure 4.21 Southeast Carson City Bike Route Map

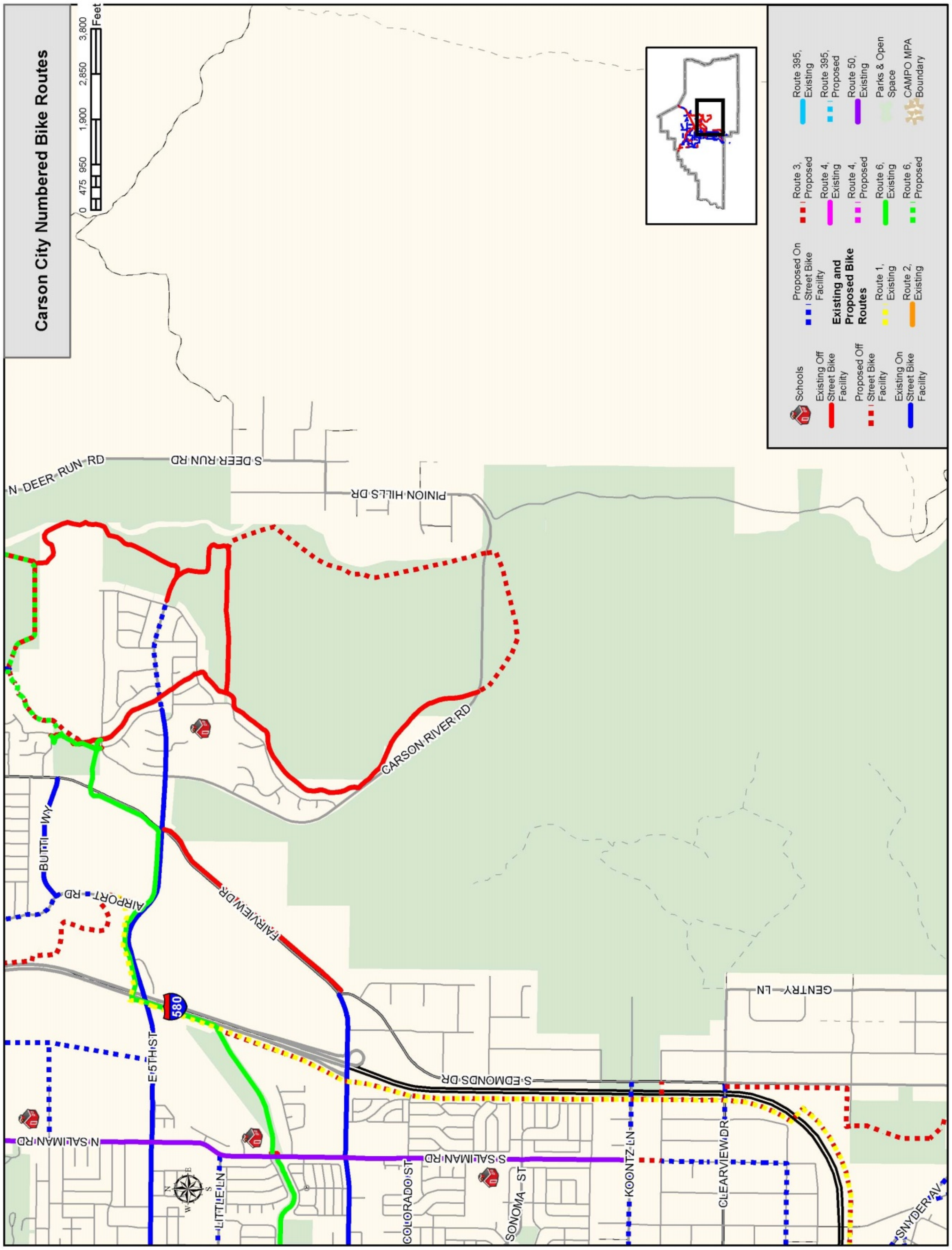


Figure 4.22 Southwest Carson City Bike Route Map

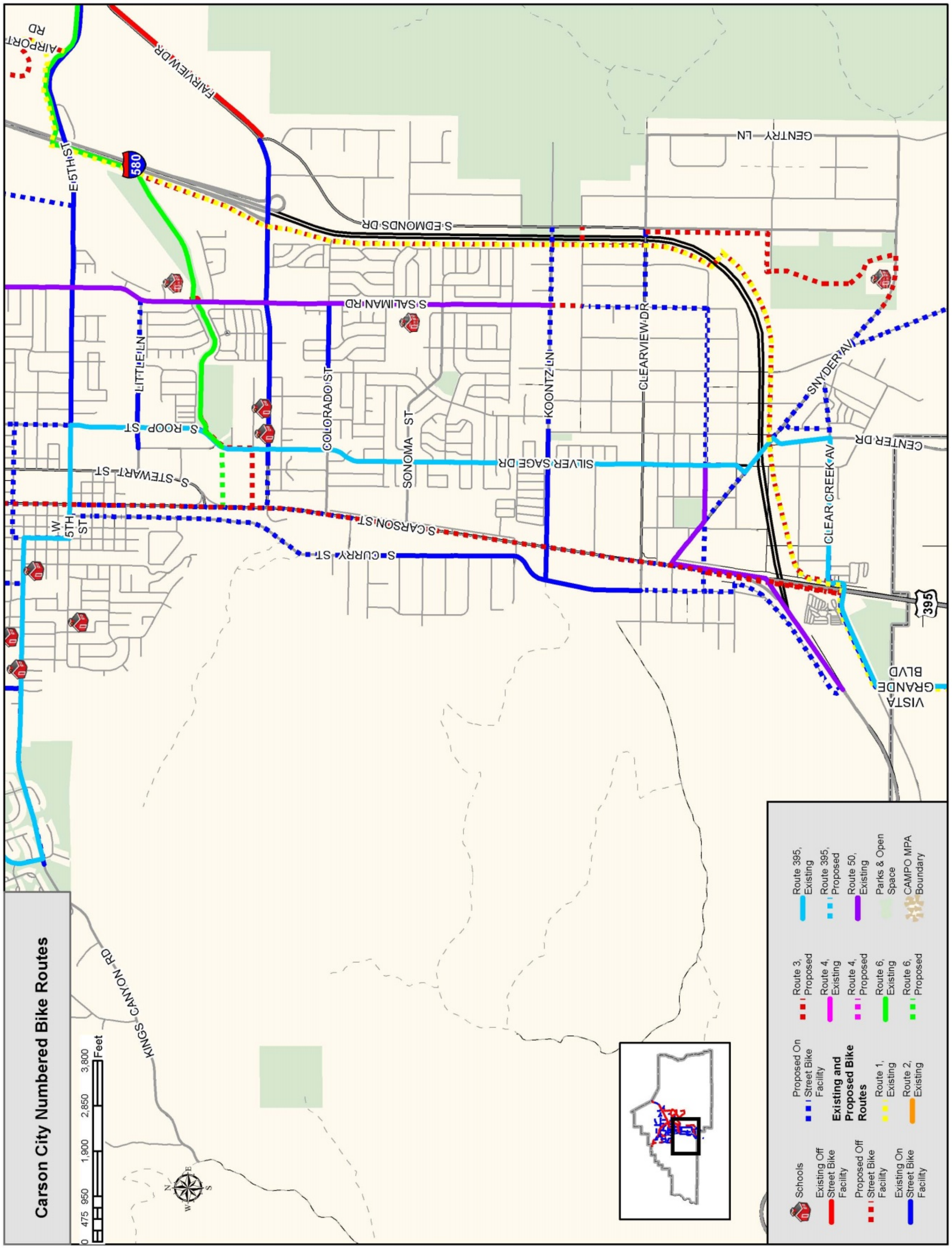


Figure 4.23 Northwest Carson City Bike Route Map

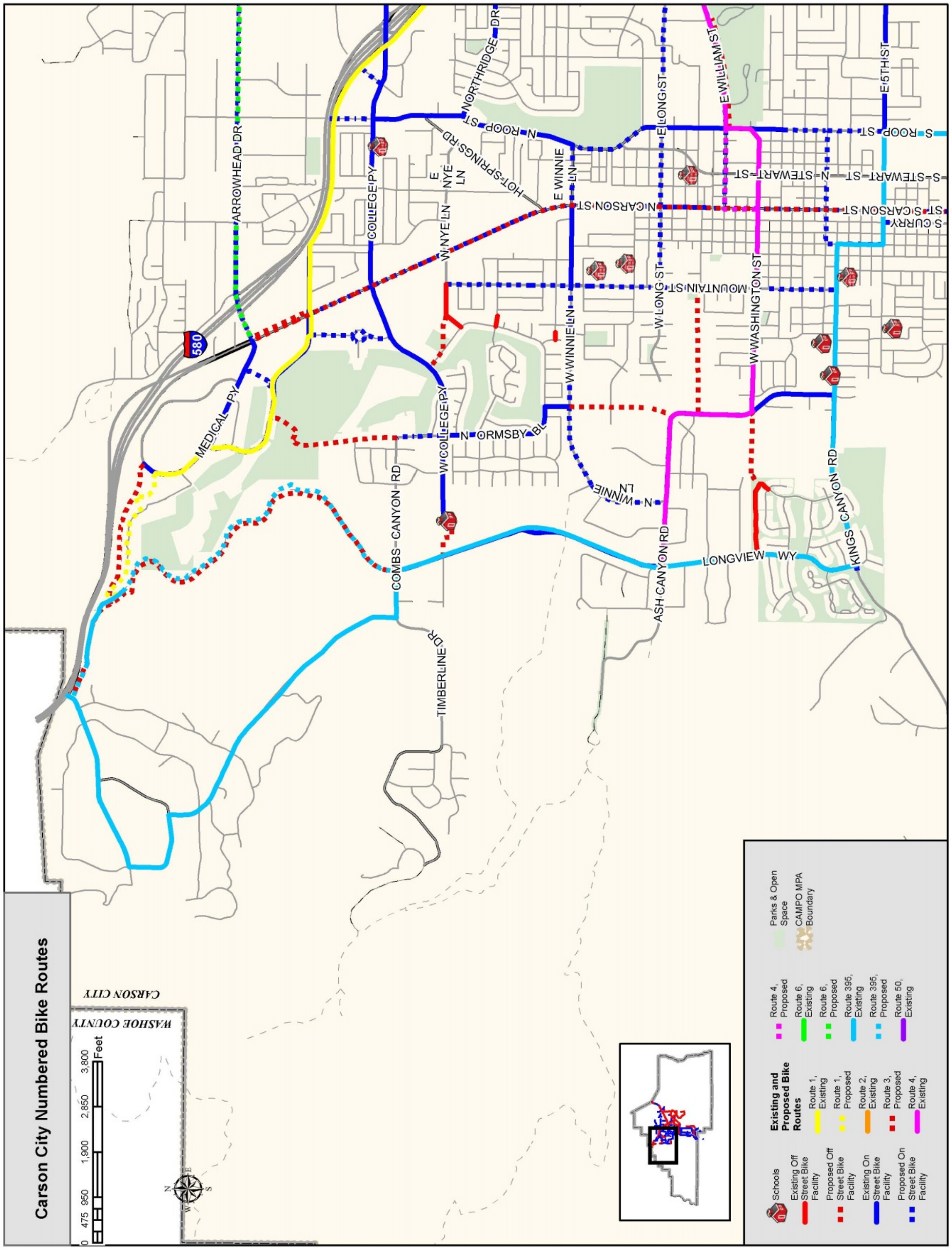


Figure 4.24 - Douglas County Proposed Bike Network

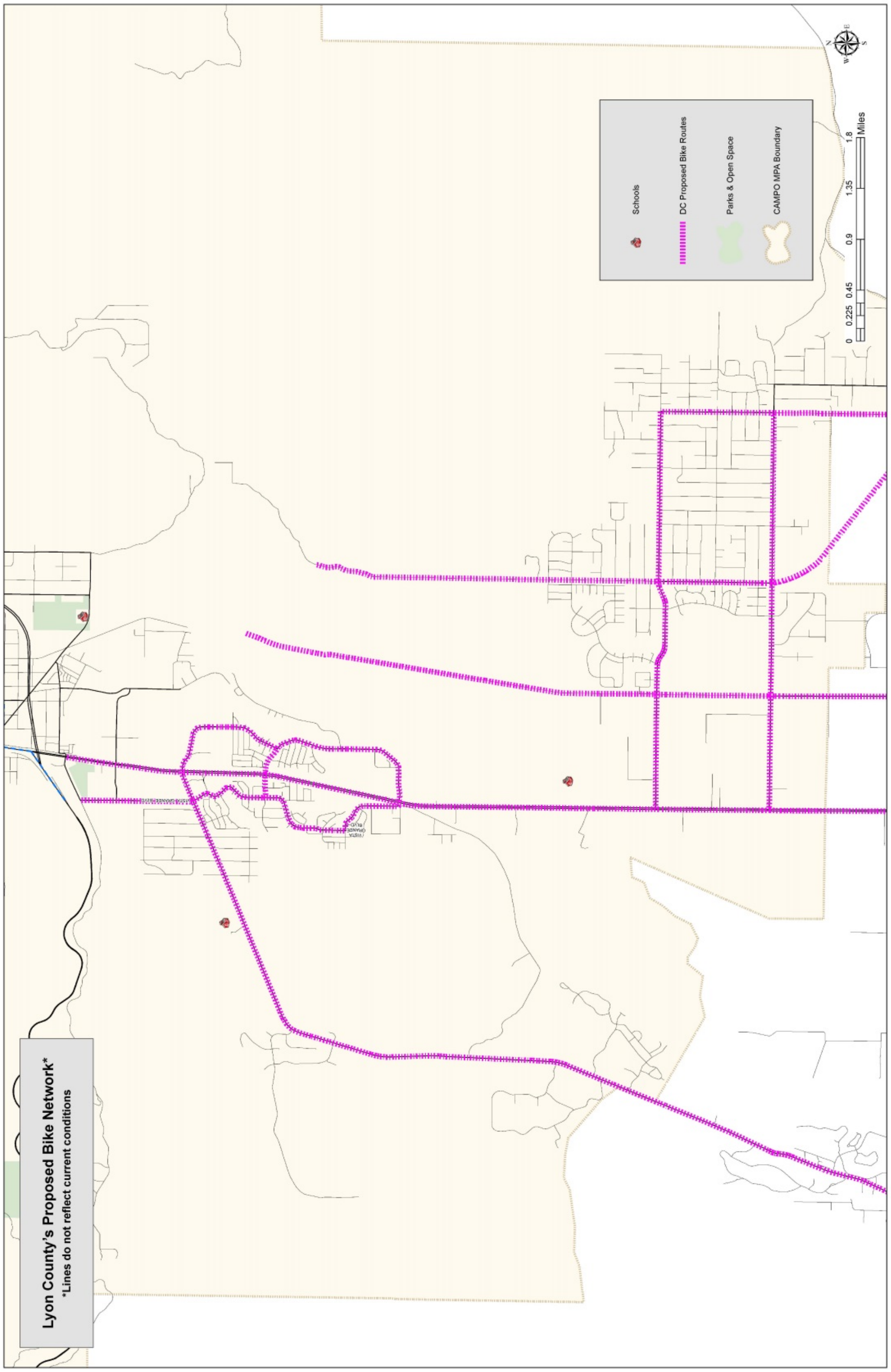
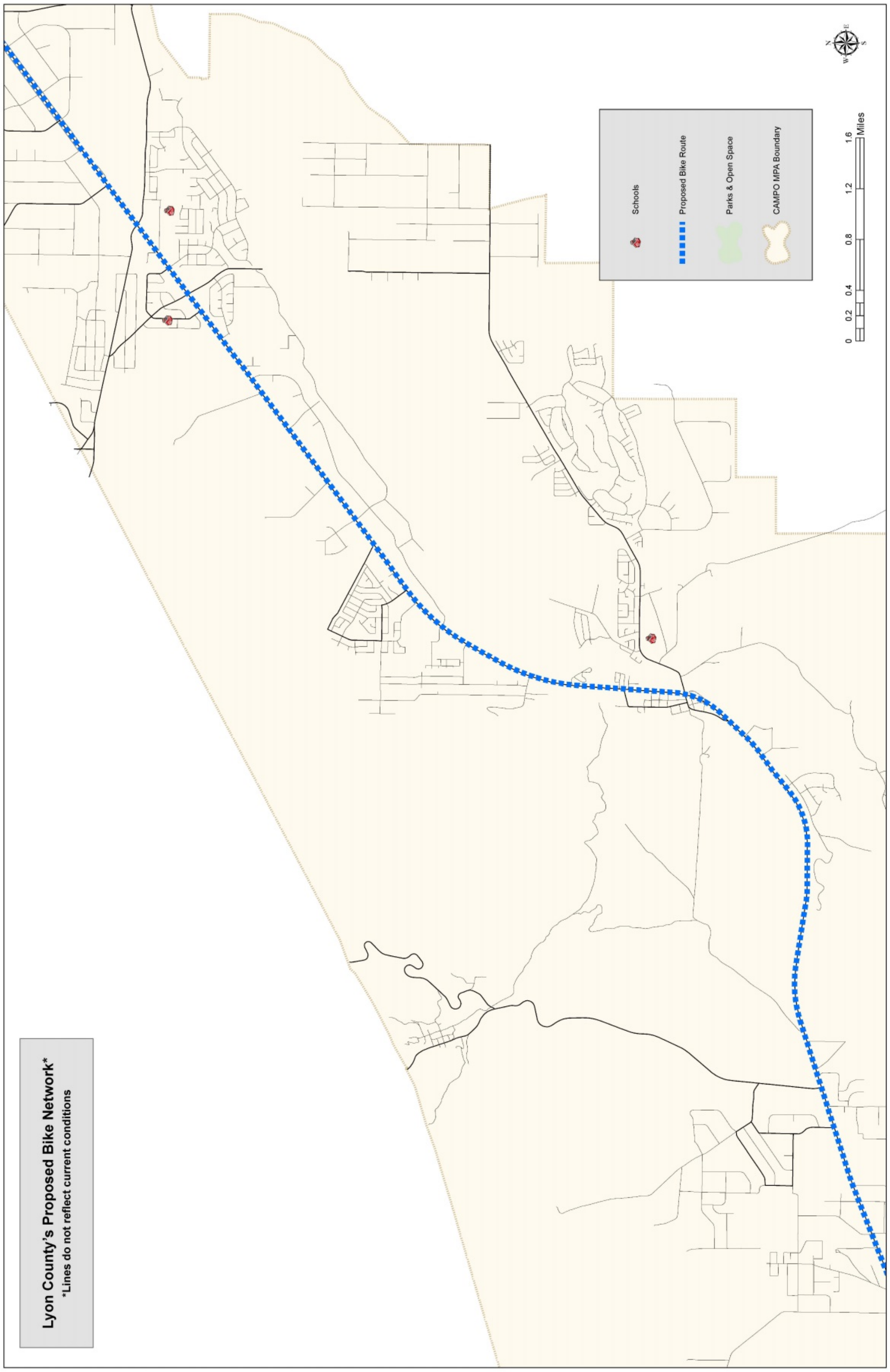


Figure 4.25 - Lyon County Proposed Bike Network



Public Transportation

Public transportation provides improved mobility and access throughout the Carson Area. Presently, the principal benefit is safe and reliable transportation for the transit dependent population, a demographic that is anticipated to grow due to longer life spans and Nevada's attractive retirement atmosphere. Due to the dispersed pattern of residential, employment areas, and the region's mild traffic congestion, public transportation is not the preferred mode of travel. However, public transit provides an important complementary resource to active transportation and ride sharing users, allowing users to pair public transportation with other modes of travel. Public transportation provides access to jobs, community facilities, retail establishments, and healthcare facilities to individuals who cannot afford or are unable to drive a personal vehicle. Additionally, public transportation reduces traffic congestion and transportation emissions, providing a regional benefit.

In the Carson Area, public transportation (shared transportation available to the public for a fee) options are bus services and ride hailing services. Bus service providers include four public and two private sources and are listed below. Ride hailing services within the Carson area include Capital Cabs Company and UBER.

- Jump Around Carson (JAC), administered by the Carson City Regional Transportation Commission (RTC), is the primary provider for the Carson City area
- RTC Intercity, an intercity bus service between Carson City and Reno, operated by RTC of Washoe County with funding from Carson City RTC
- Douglas Area Rural Transit (DART), a dial a ride service for seniors and disabled riders, operated by Douglas County
- BlueGo, with bus services between Lake Tahoe, Carson City, and Douglas County operated by the Tahoe Transportation District
- Carson Valley Airporter, operated by Amador Coach Line, is a private company that provides bus services from Douglas County and Carson City to the Reno Tahoe Airport
- Silverado Mainline, operated through a public-private partnership between the Nevada Department of Transportation and Silverado Mainline, provides daily services between Las Vegas and Reno, includes a stop in Carson City.

The Federal Transit Administration (FTA) provides grant funding that requires local match, to CAMPO and the other transit providers. Without these federal grant funds, public transportation would not be financially feasible. The utilization of these federal grant funds supports needed public transportation and brings millions of dollars to the local and regional economy.

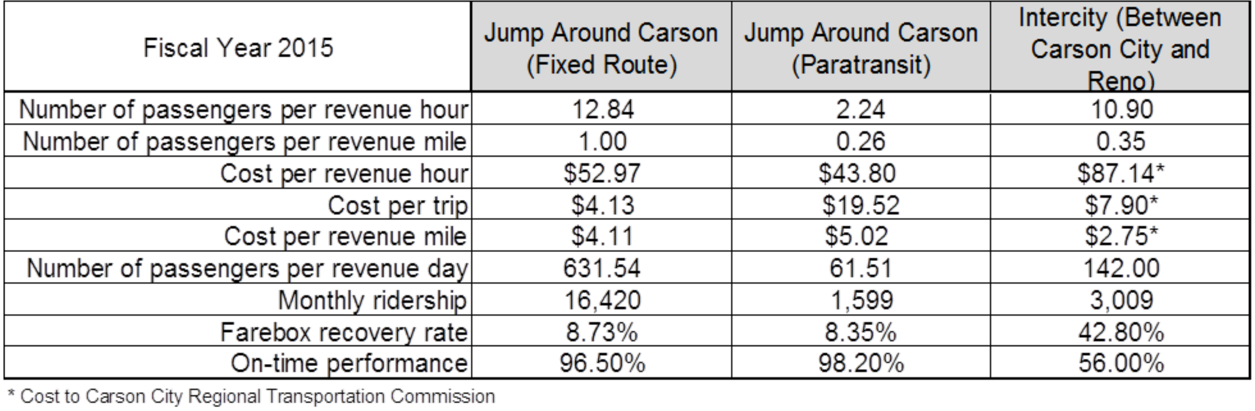
As healthcare services, employment areas, and other destinations continue to straddle jurisdictional lines, transit providers will need to help riders navigate from one transit service to another, allowing riders to transfer throughout the region seamlessly.

Public transportation supports a goal of this plan, which is to increase the mobility and reliability of the transportation system for all users. In compliance with new federal regulations on performance based planning, this plan establishes the following objective and performance measures for the two transit services receiving Federal Transit Administration (FTA) grant funding through CAMPO.

Objective: Improve transit system efficiencies and accessibilities

- Performance Measure: The number of passengers per revenue hour/mile/day for Jump Around Carson and RTC Intercity
- Performance Measure: The cost per revenue hour/mile/trip for Jump Around Carson and RTC Intercity
- Performance Measure: The number of passengers per day for Jump Around Carson and RTC Intercity
- Performance Measure: Monthly ridership for Jump Around Carson (fixed route and paratransit) and RTC Intercity
- Performance Measure: Farebox recovery rate for Jump Around Carson and RTC Intercity
- Performance Measure: On-time performance (departure from a time point between zero and five minutes is considered on time) for Jump Around Carson's fixed routes and RTC Intercity route.

Figure 4.26 Fiscal Year 2015 Performance Measures



Fiscal Year 2015	Jump Around Carson (Fixed Route)	Jump Around Carson (Paratransit)	Intercity (Between Carson City and Reno)
Number of passengers per revenue hour	12.84	2.24	10.90
Number of passengers per revenue mile	1.00	0.26	0.35
Cost per revenue hour	$52.97	$43.80	$87.14*
Cost per trip	$4.13	$19.52	$7.90*
Cost per revenue mile	$4.11	$5.02	$2.75*
Number of passengers per revenue day	631.54	61.51	142.00
Monthly ridership	16,420	1,599	3,009
Farebox recovery rate	8.73%	8.35%	42.80%
On-time performance	96.50%	98.20%	56.00%

* Cost to Carson City Regional Transportation Commission

Jump Around Carson (JAC)

Carson City Regional Transportation Commission operates Jump Around Carson (JAC), a public bus service. Governed by the Carson City Regional Transportation Commission (RTC), JAC provides four fixed routes that meet at a transfer station hourly. 62% of the Carson City population is within a quarter mile of one of the fixed routes.

Hours of Operation are Monday through Friday, 6:30 a.m. to 7:30 p.m., and Saturday 8:30 a.m. to 4:30 p.m. Each route operates on 60-minute headway from the Downtown Transfer Plaza, which facilitates transfers to the entire service area. Fares are $1.00 for adults and $0.50 for children ages 5-18, seniors 60 and over and persons with disabilities. Children under age five ride free.

With use of Federal Transit Administration funds for fixed route bus services, JAC is required to provide complementary paratransit service. JAC Assist, an ADA paratransit service, provides curb-to-curb transportation for eligible persons with disabilities who cannot use the fixed route bus service. JAC Assist operates during the same days and hours as the fixed route system. Fares are $2.00 per one-way trip with an origin and destination within ¾ mile of any fixed route. As a matter of local policy, paratransit service is provided an additional ¼-mile (total of 1 mile from any fixed route) for a fare of $4.00 per one-way trip with an origin or destination within this non-ADA zone.

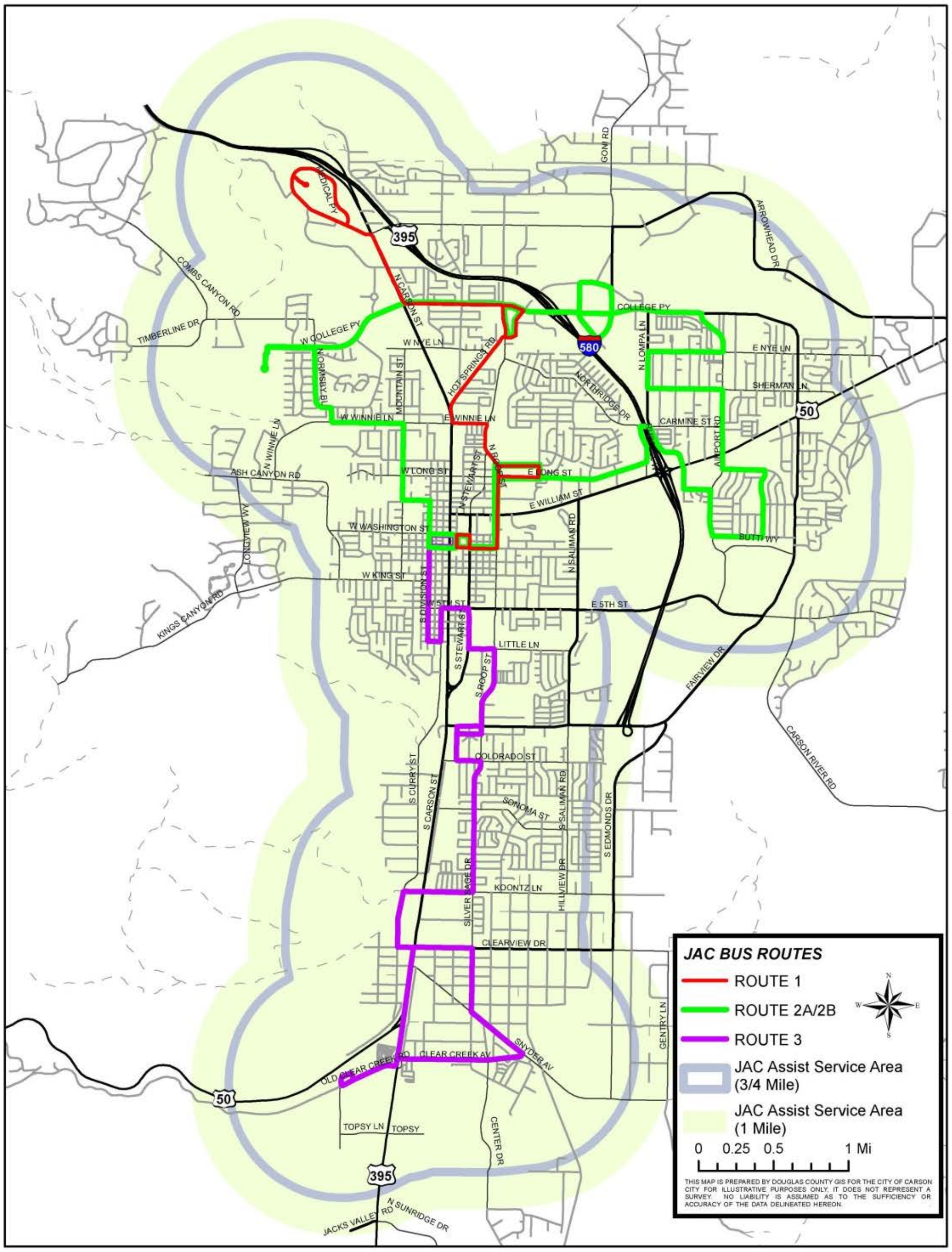
Future expansion of JAC operations is evaluated in the Carson City Transit Development Plan. The plan is a short range-planning document for fiscal years 2014-2018. The document evaluates the existing system, potential improvements to the system, and provides options to expand the system while maximizing benefit to riders and the community. Future expansion options would require additional local resources to leverage more federal funds.

* The Carson City Transit Development Plan is available on the Jump Around Carson webpage:
www.ridejac.com

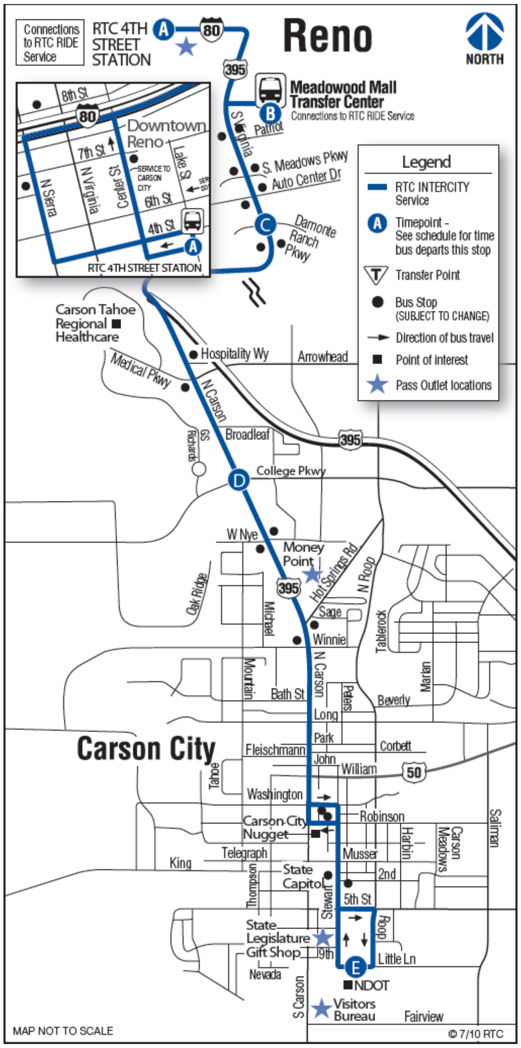
Figure 4.27 shows JAC's four fixed routes and the JAC Assist Service Area for paratransit. The paratransit service area is represented by the shaded buffer area around JAC's fixed routes. The four fixed routes are listed below:

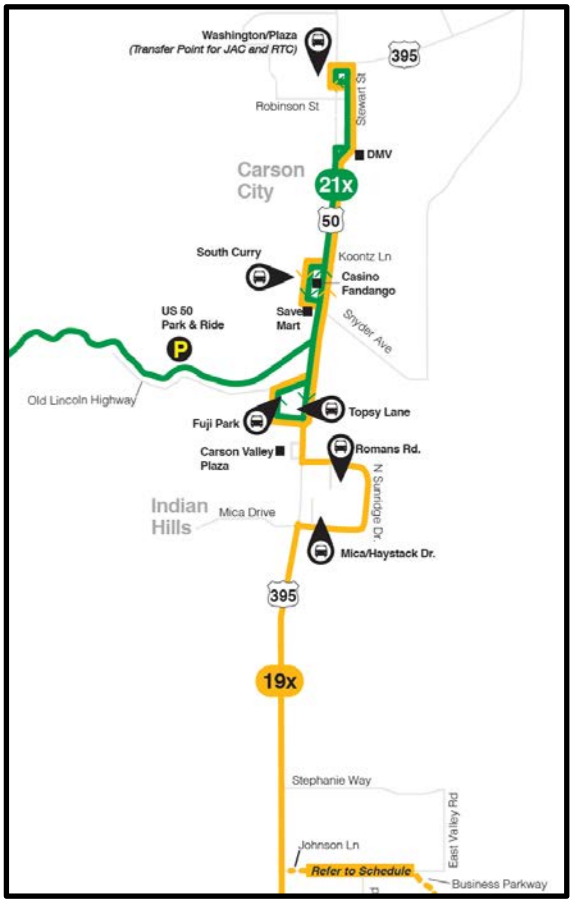
- Route 1 – North Carson Area
- Route 2A – North Town West/East Carson Area (clockwise)
- Route 2B – North Town East/West Carson Area (counter-clockwise)
- Route 3 – South Carson Area

Figure 4.27 JAC and JAC Assist Service Area



In partnership, the Carson City RTC and the RTC of Washoe County provide intercity bus service between Carson City and Reno Monday through Friday. The service offers reclining seats, individual climate control, storage space for small personal items, and free Wi-Fi. Passengers are able to transfer between JAC, BlueGo, and RTC Ride (Washoe County's bus system) at no additional cost. This service provides approximately 10,000 plus rides to students enrolled in the University of Nevada Reno and the Truckee Meadows Community College. Total annual ridership is estimated at 36,000.





Operated by the Tahoe Transportation District, BlueGo operates a commuter bus service between South Lake Tahoe, Carson City and the Carson Valley known as the Lake & Valley Express. The Lake & Valley Express operates mainly Monday through Friday, with a reduced schedule on weekends. Passengers are able to transfer between JAC buses and Douglas Area Rural Transit (DART) buses. BlueGo also operates a fixed route service, the seasonal Nifty 50 Trolley, and seasonal ski shuttles that serve the greater South Lake Tahoe area.

Douglas Area Rural Transit
DART
Going The Extra Mile
775-783-6455 775-783-6456

Operated by Douglas County, Douglas Area Rural Transit (DART) is primarily a dial-a-ride curb-to-curb bus service for senior and disabled riders. The dial-a-ride service area includes the Johnson Lane and Indian Hills residential areas, which are both located within the CAMPO boundary. While transfer agreements are not in place, DART riders are able to transfer onto other regional bus services to reach their destination. DART operates a small public fixed route service called DART Express within the Minden/Gardnerville area (outside of the CAMPO boundary). DART Express bus stops are planned around existing BlueGo stops, which provide access to Carson City and South Lake Tahoe.

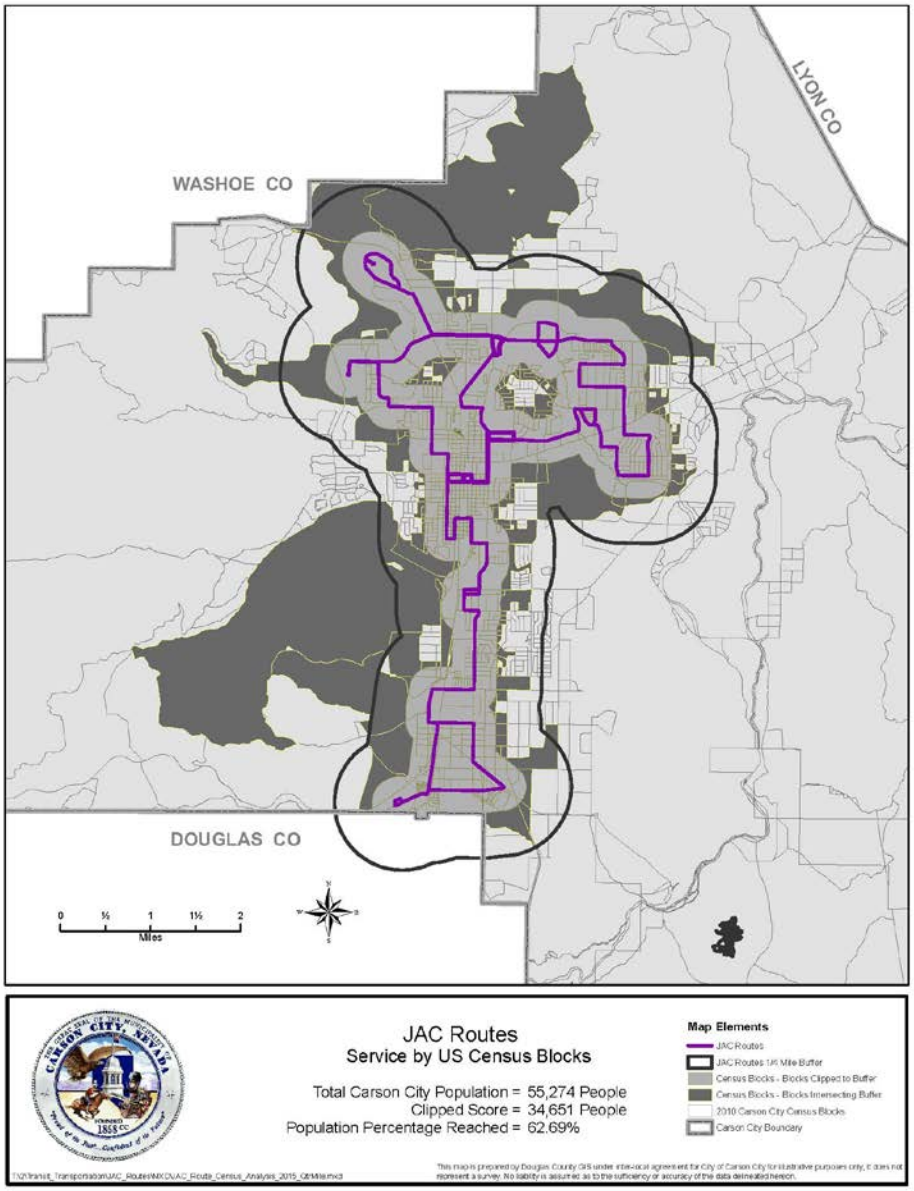
The Carson Valley Airporter is a privately run bus service providing one way and roundtrip transportation from Douglas County and Carson City to the Reno Airport. Amador Stage Lines provide this service. The service performs daily stops at the following locations:

- Gardnerville Community Center in Douglas County
- Carson Valley Inn in Douglas County
- Holiday Inn Express in Minden in Douglas County
- Courtyard by Marriott in Carson City
- Carson City at the Downtown Transfer Plaza (intersection of Robinson & Plaza Streets)
- Hampton Inn in Carson City
- Reno National Bowling Center
- Reno-Tahoe International Airport

Title VI and Environmental Justice

Title VI of the Civil Rights Acts of 1964 prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance. CAMPO has guidelines set by the FTA to ensure nondiscrimination. Environmental Justice works towards identifying and addressing the effects of all programs, policies, and activities on minority and low-income populations. CAMPO works to develop transportation projects that fit within the region without sacrificing safety or mobility.

Figure 4.28 JAC Routes throughout Census Blocks


LYON CO
WASHOE CO
DOUGLAS CO
0
½
1
1½
2
Miles
JAC Routes
Service by US Census Blocks
Total Carson City Population = 55,274 People
Clipped Score = 34,651 People
Population Percentage Reached = 62.69%
Map Elements
JAC Routes
JAC Routes 1/4 Mile Buffer
Census Blocks - Blocks Clipped to Buffer
Census Blocks - Blocks Intersecting Buffer
2010 Carson City Census Blocks
Carson City Boundary
This map is prepared by Douglas County GIS under inter-local agreement for City of Carson City for illustrative purposes only, it does not represent a survey. No liability is assumed as to the sufficiency or accuracy of the data delineated hereon.
T:\2\Transit_Transportation\JAC_Routes\MXD\JAC_Route_Census_Analysis_2015_QtMile.mxd

Chapter 5: Safety

CAMPO is committed to creating a safer transportation network for all users and modes of transportation. The cause of crashes typically includes multiple factors, such as driver error, roadway conditions, and roadway design. The Carson Area transportation network is over a hundred years old and is in need of safety improvements. Prioritizing network improvements is difficult, especially with limited resources. Additionally, transportation improvements can have significant impacts on local land use, which includes homes and businesses, making the selection of improvements more difficult.

In January 2012, the Federal Highway Administration (FHWA) began promoting the implementation of proven safety countermeasures. Through research, these safety measures have shown great effectiveness in improving safety throughout the country. These safety measures address access management, design elements for non-motorized users, intersection design, roadway treatments, and traffic signal visibility. All three-member agencies of CAMPO, to some degree, have begun to implement these proven safety countermeasures. These proven safety trends are discussed in detail within this chapter.

To help local decision makers and transportation professionals prioritize improvements and gauge the effectiveness of safety improvements, national safety performance measures have been established. Consistent with federal regulations, this chapter establishes objectives and performance measures to track progress toward creating a safer transportation system. Four objectives and seven performance measures are incorporated into this plan for future comparison. The objectives and 2014 performance measures are listed below:

Objective: Reduce the number of transportation system fatalities

Objective: Reduce the number of transportation system serious injuries

Objective: Reduce the rate of transportation system fatalities

Objective: Reduce the rate of transportation system serious injuries

2014 Safety Performance Measures

- 1.6* - Number of Fatal Crashes
- 16.8* - Number of Serious Injury*** Crashes
- 0.2* - Number of Fatal Crashes involving a Bicyclist or Pedestrian
- 2.0* - Number of Serious Injury*** Crashes involving a Bicyclist or Pedestrian
- 0.28** - Rate of Fatal Crashes
- 2.94** - Rate of Serious Injury*** Crashes
- 0.0 - Number of Fatal Crashes involving Trucks

*The number is expressed as a five year rolling average
**Rate is expressed as the number of crashes per 100 million vehicle miles traveled
***A serious injury is defined by the National Safety Council (NSC) as incapacitating per the KABCO scale

Safety Trends

In January 2012, the Federal Highway Administration (FHWA) began promoting the implementation of proven safety countermeasures. Through research, these safety measures have shown great effectiveness in improving safety.

Information on each countermeasure is available on FHWA's website at the following link: http://safety.fhwa.dot.gov/provencountermeasures/.

Roundabouts

Corridor Access Management

Backplates with Retroreflective Borders

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

Enhanced Delineation and Friction for Horizontal Curves

Safety Edge$_{\text{SM}}$

Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

Pedestrian Hybrid Beacon

Road Diet

A brief description of each countermeasure is provided below:

Roundabouts

A roundabout is a type of circular intersection or junction in which road traffic flows almost continuously in one direction around a central island. Compared to stop signs, traffic signals, and earlier forms of roundabouts, modern roundabouts reduce the likelihood and severity of collisions by reducing traffic speeds and minimizing T-bone and head-on collisions. Roundabouts reduce conflict points from 32 to 8 at a standard intersection.

Corridor Access Management

Access management is a set of techniques that State and local governments use to control access to highways, major arterials, and other roadways.

Backplates with Retroreflective Borders

Backplates are added to a traffic signal indication to improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. The borders also assist colorblind drivers in navigating an intersection.

Longitudinal Rumble Strips and Stripes on Two-Lane Roads

Longitudinal rumble strips are milled or raised elements on the pavement intended to alert inattentive drivers through vibration and sound that their vehicles have left the travel lane. Rumble strips are not recommended where bicyclists use shoulders unless there is a minimum clear path of four feet in which a bicycle may safely operate and there is a 12-foot longitudinal gap in the rumble strip every 60 feet.

Enhanced Delineation and Friction for Horizontal Curves

Enhanced delineation or friction to a roadway curve includes adding signs and markings to help drivers safely negotiate curves or pavement surface treatment that improves roadway friction keeping vehicles on the roadway.

Safety Edge$_{SM}$

The Safety Edge$_{SM,}$ an NDOT design standard, is a proven technology that shapes the edge of a paved roadway at approximately 30 degrees from the pavement cross slope during the paving process. The Safety Edge$_{SM}$ eliminates tire scrubbing, a phenomenon that contributes to losing control of a vehicle and rollovers. The Safety Edge is an NDOT design standard.

Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

Pedestrian or median crossing islands—also known as center islands, refuge islands, or median slow points—are raised islands placed on a street at intersections or midblock locations to separate crossing pedestrians from motor vehicles.

Pedestrian Hybrid Beacon

The pedestrian hybrid beacon (also known as the High intensity Activated crossWalK (or HAWK)) is a pedestrian-activated warning device located on the roadside or on mast arms over midblock pedestrian crossings. The beacon head consists of two red lenses above a single yellow lens. The beacon head is “dark” until the pedestrian desires to cross the street.

Road Diet

A ***road diet***, also called a lane reduction or ***road*** rechannelization, is a technique in transportation planning whereby the number of travel lanes and/or effective width of the ***road*** are reduced to achieve systemic improvements.

Safety Performance

In compliance with new performance based planning requirements, this plan establishes seven performance measures that will create a baseline for future comparison and will evaluate regional progress toward achieving the plan's safety objectives. These performance measures are requirements of the previous transportation bill Moving Ahead for Progress in the 21st Century (MAP-21) and of the recently approved transportation act, Fixing America's Surface Transportation (FAST) Act. The Nevada Department of Transportation and Nevada's four metropolitan planning organizations (MPO) have agreed to specific language of the performance measures to allow for comparison throughout the state and among MPOs. Additionally, use of the Fatality Analysis Reporting System (FARS) data will be used to ensure consistency over time and accurate comparison. The performance measures are listed below:

- Performance Measure: Rate of serious injuries classified as type A on the KABCO scale calculated by the number of crashes as a 5-year moving average per 100 million VMT (vehicle miles traveled) in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of serious crashes (injuries classified as type A on the KABCO scale) in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of serious injuries involving a bicyclist or pedestrian in the CAMPO boundary
- Performance Measure: Rate of fatalities calculated by the number of fatalities as a 5-year moving average per 100 million VMT (vehicle miles traveled) in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of fatal crashes in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of fatal crashes involving a bicyclist or pedestrian in the CAMPO boundary
- Performance Measure: Number (5-year rolling average) of fatal crashes involving trucks in the CAMPO boundary

Performance Measure Reporting

FARS is a nationwide census providing the National Highway Traffic Safety Administration (NHTSA), Congress, and the American public yearly data regarding fatal injuries suffered in motor vehicle traffic crashes. In an effort to smooth out the annual data and identify trends, the performance measures use a five-year rolling average to track the number of crashes. With NDOT's assistance, the following vehicle miles traveled (VMT) have been estimated for the CAMPO Planning Area, and were used for the two performance measures expressing rate per 100 million miles of VMTs.

Figure 5.0 Annual Vehicle Miles Traveled in the CAMPO Planning Area

Year	Vehicle Miles Traveled
2010	458,370,939
2011	470,558,752
2012	487,520,736
2013	487,200,339
2014	571,234,641

Source: Nevada Department of Transportation

Figure 5.1 Safety Performance Measures

Calender Year	Number* of Fatal Crashes	Rate** of Fatal Crashes	Number of Serious Injury Crashes	Rate of Serious*** Injury Crashes	Number of Fatals Crashes involving Bicyclist or Pedestrian	Number of Serious Injury Crashes involving Bicyclist or Pedestrian	Number of Fatal Crashes involving Trucks
2010	2.2	0.48	13.0	2.84	0.60	1.4	0
2011	2.2	0.47	14.6	3.10	0.40	1.4	0
2012	2.2	0.45	14.2	2.91	0.40	0.8	0
2013	2.0	0.41	14.8	3.04	0.60	1.0	0
2014	1.6	0.28	16.8	2.94	0.20	2.0	0

* The number is expressd as a five year rolling average

** Rate is expressed as the number of crashes per 100 million vehicle miles traveled

*** A serious injury is defined by the National Safety Council (NSC) as incapacitating

Crash Maps

Crash maps have been created with all available crash data. The data is from 2006 to the present, however, due to the legal matters associated with crashes data can lag. The maps have been created to allow for a spatial analysis of crashes in the CAMPO Planning Area. Due to the multiple factors that cause crashes, it is difficult to use maps to identify a problem or a deficiency in the roadway. Additionally, and specific to the CAMPO area, due to the changing transportation network, specifically the construction of the Carson City Freeway, past problem areas that have seen reductions in congestion may no longer be a problem.

Maps of vehicle crashes and crashes involving bikes or pedestrians are provided for reference. A list of the maps is provided below:

- Figure 5.2 Carson City Vehicle Crashes 2006 - 2015
- Figure 5.3 Carson City North Vehicle Crashes 2006 - 2015
- Figure 5.4 Carson City South Vehicle Crashes 2006 - 2015
- Figure 5.5 Portion of Douglas County within the CAMPO Area Vehicle Crashes 2006 - 2015
- Figure 5.6 Portion of Lyon County within the CAMPO Area Vehicle Crashes 2006 - 2015
- Figure 5.7 Portion of Douglas County within the CAMPO Area Crashes involving a Bike or Pedestrian 2006-2015
- Figure 5.8 North Carson City Crashes involving a Bike or Pedestrian 2006-2015
- Figure 5.9 South Carson City Crashes involving a Bike or Pedestrian 2006-2015
- Figure 5.10 Carson City Density Map 2006-2015

Figure 5.2 Carson City Vehicle Crashes 2006 - 2015

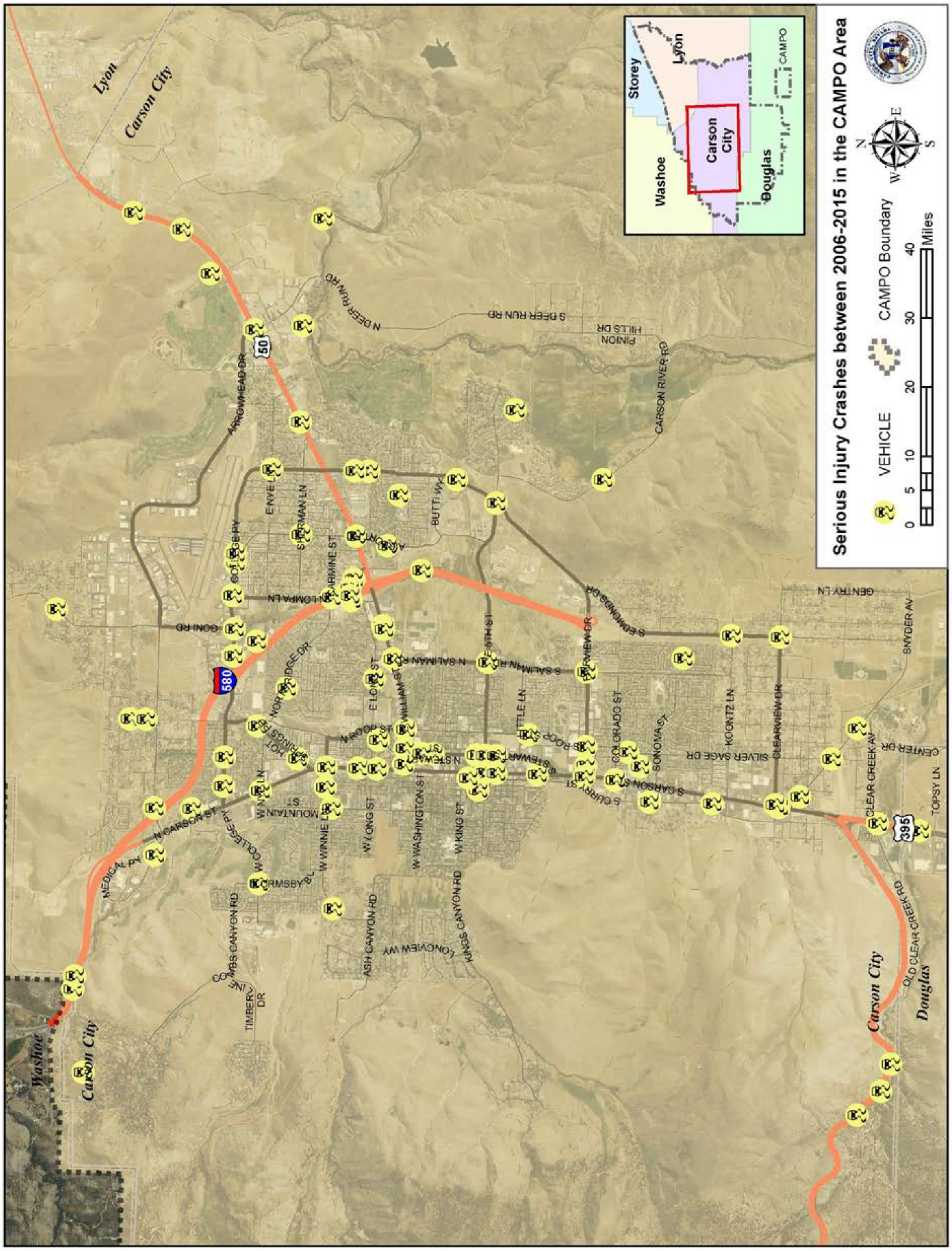


Figure 5.3 Carson City North Vehicle Crashes 2006 - 2015

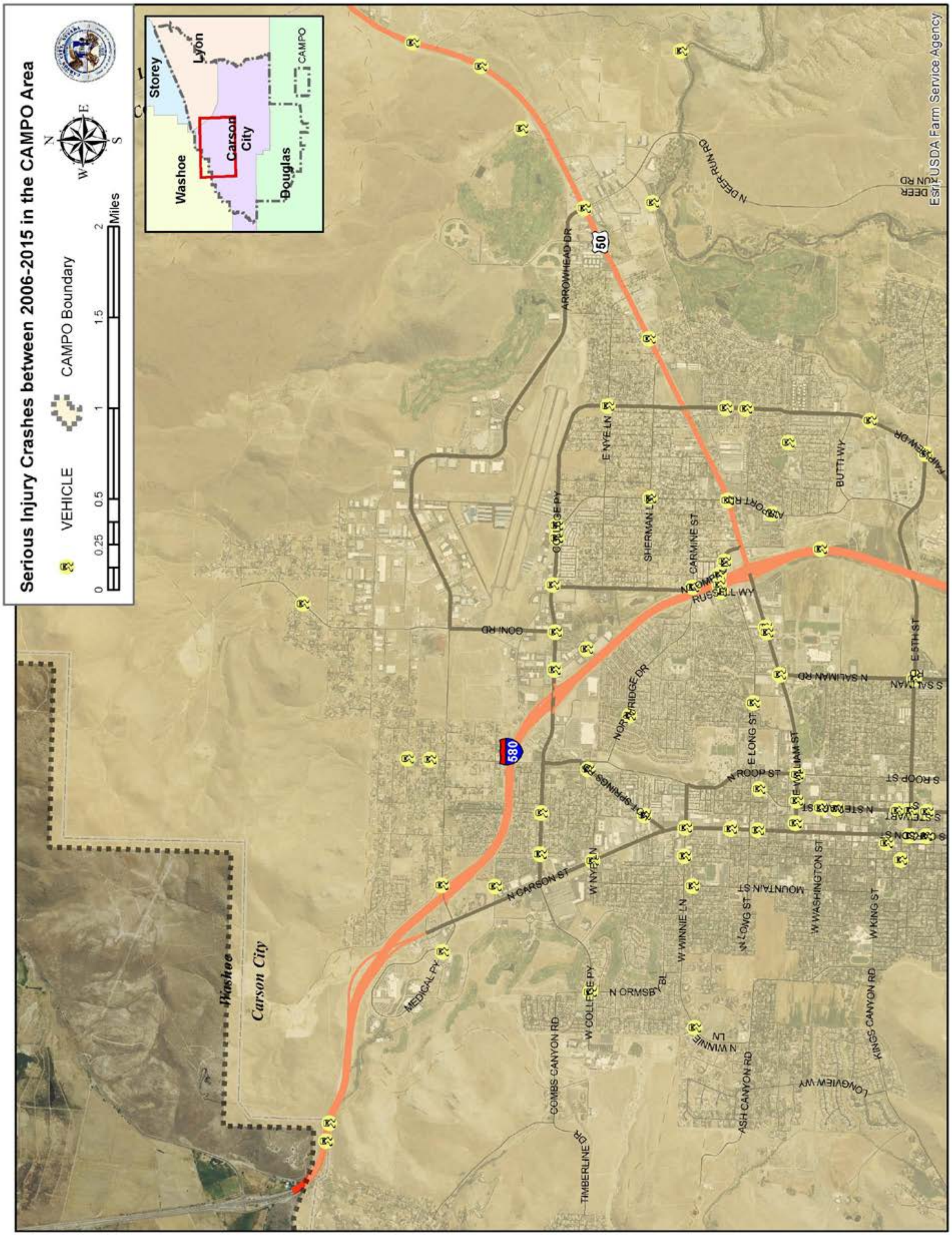


Figure 5.4 Carson City South Vehicle Crashes 2006 - 2015

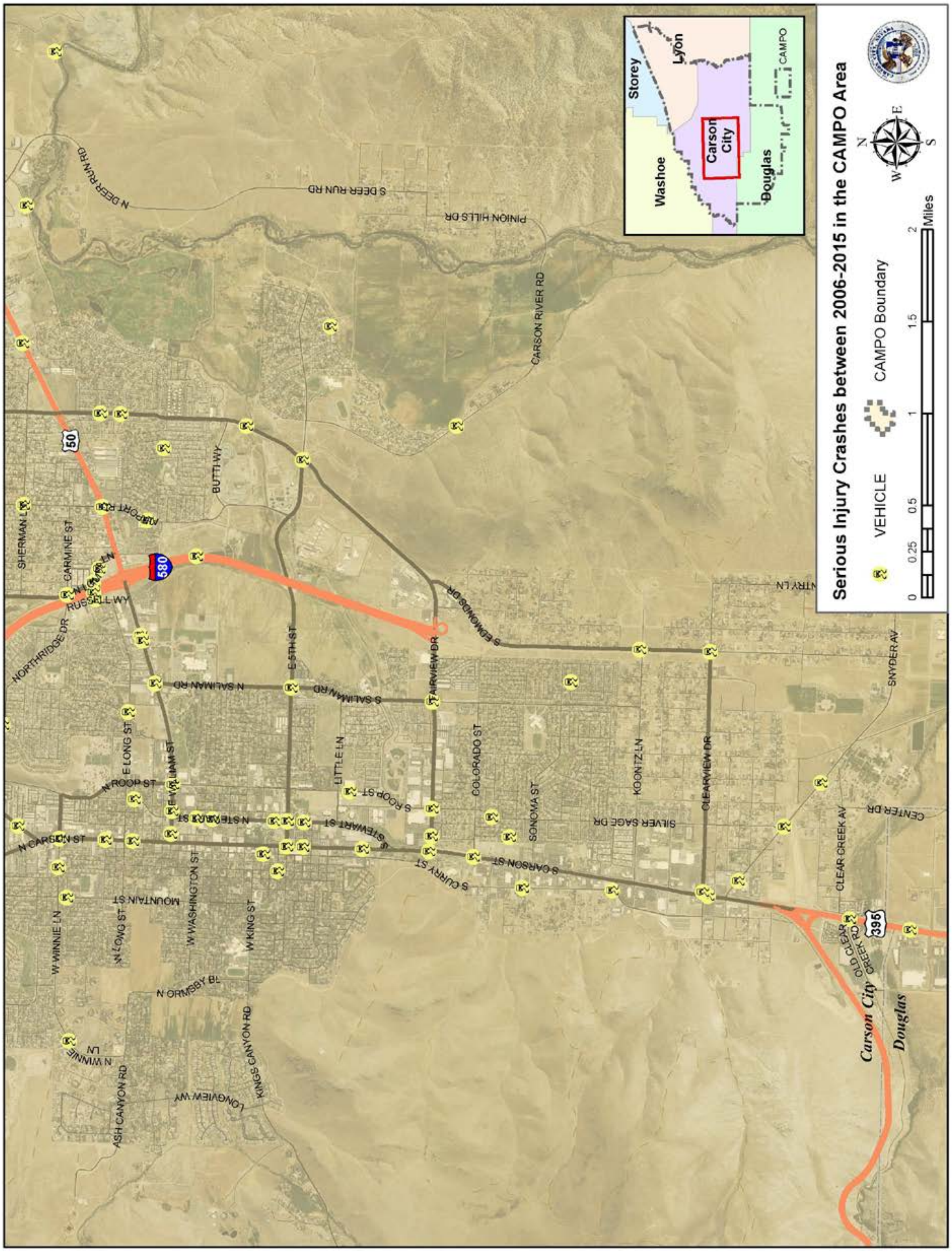


Figure 5.5 Portion of Douglas County within the CAMPO Area Vehicle Crashes 2006 - 2015

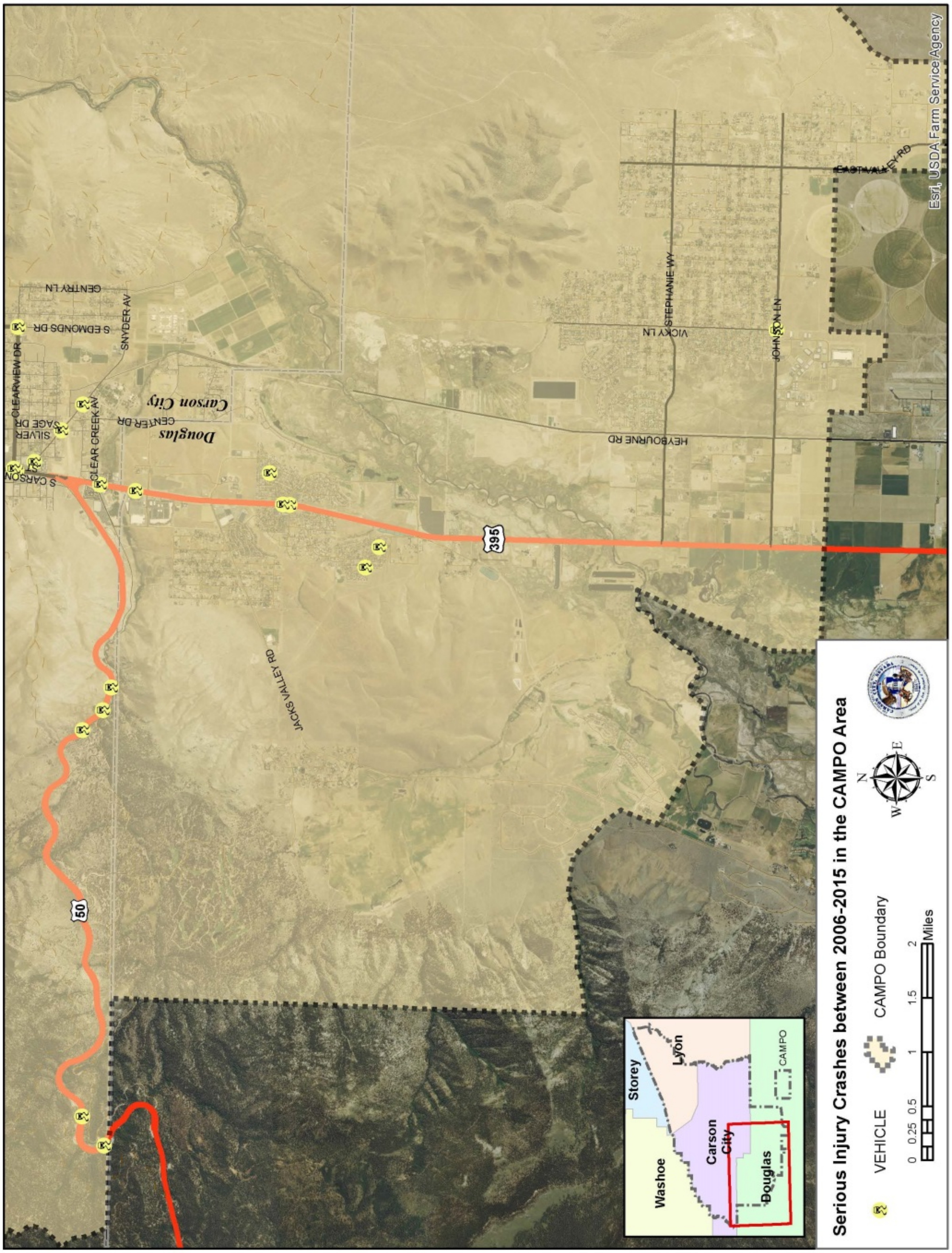


Figure 5.6 Portion of Lyon County within the CAMPO Area Vehicle Crashes 2006 - 2015

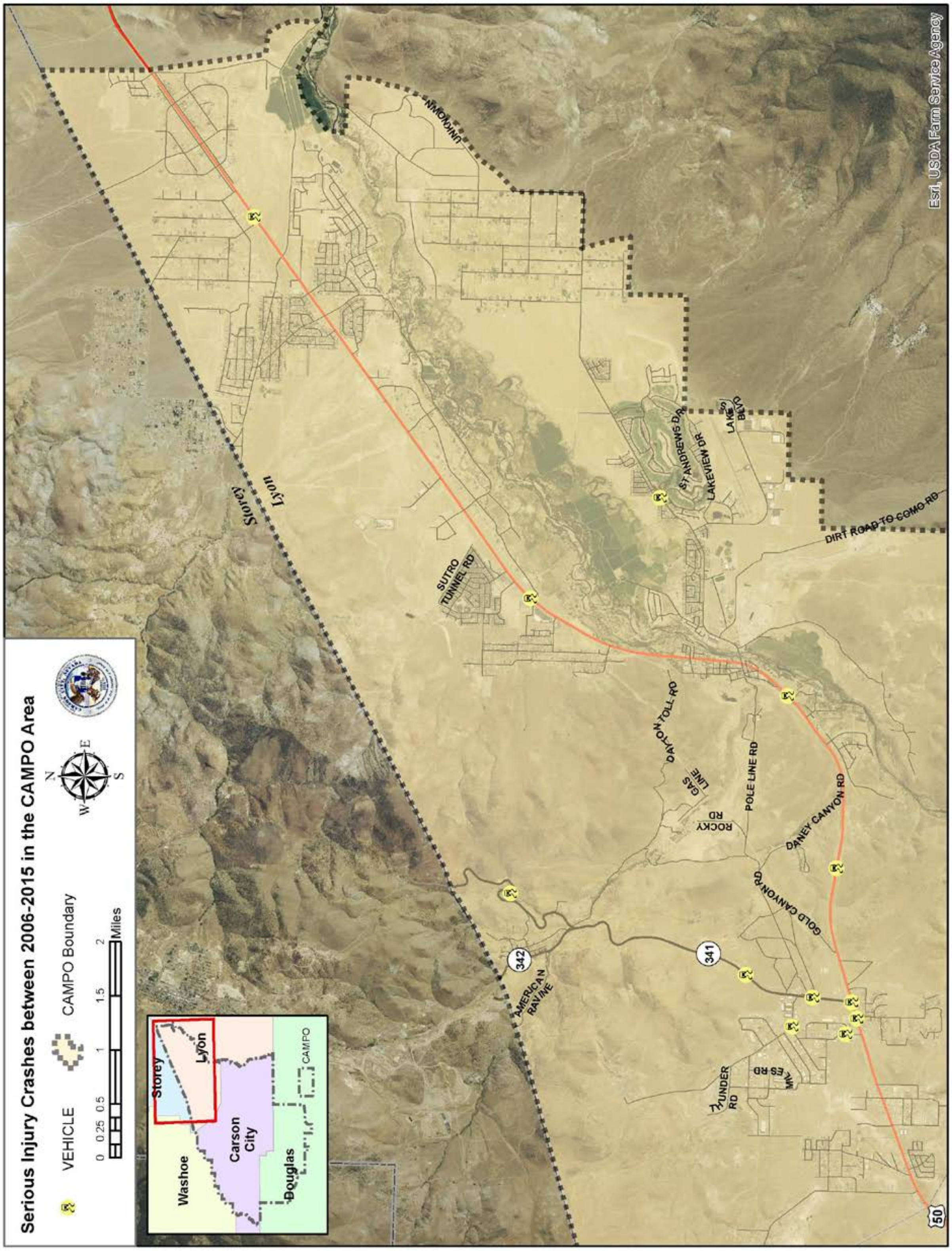


Figure 5.7 Portion of Douglas County within the CAMPO Area Crashes involving a Bike or Pedestrian 2006-2015

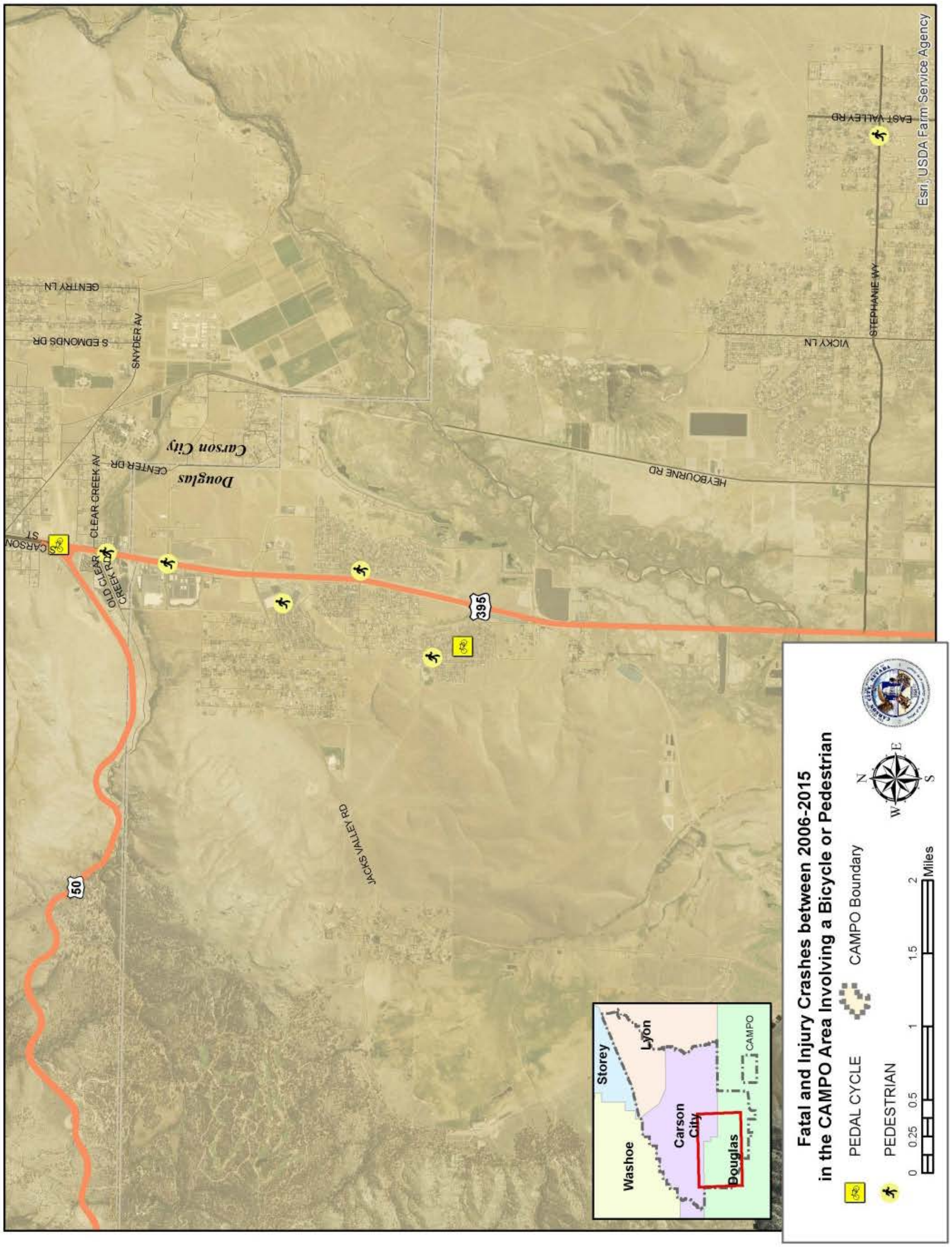


Figure 5.8 North Carson City Crashes involving a Bike or Pedestrian 2006-2015

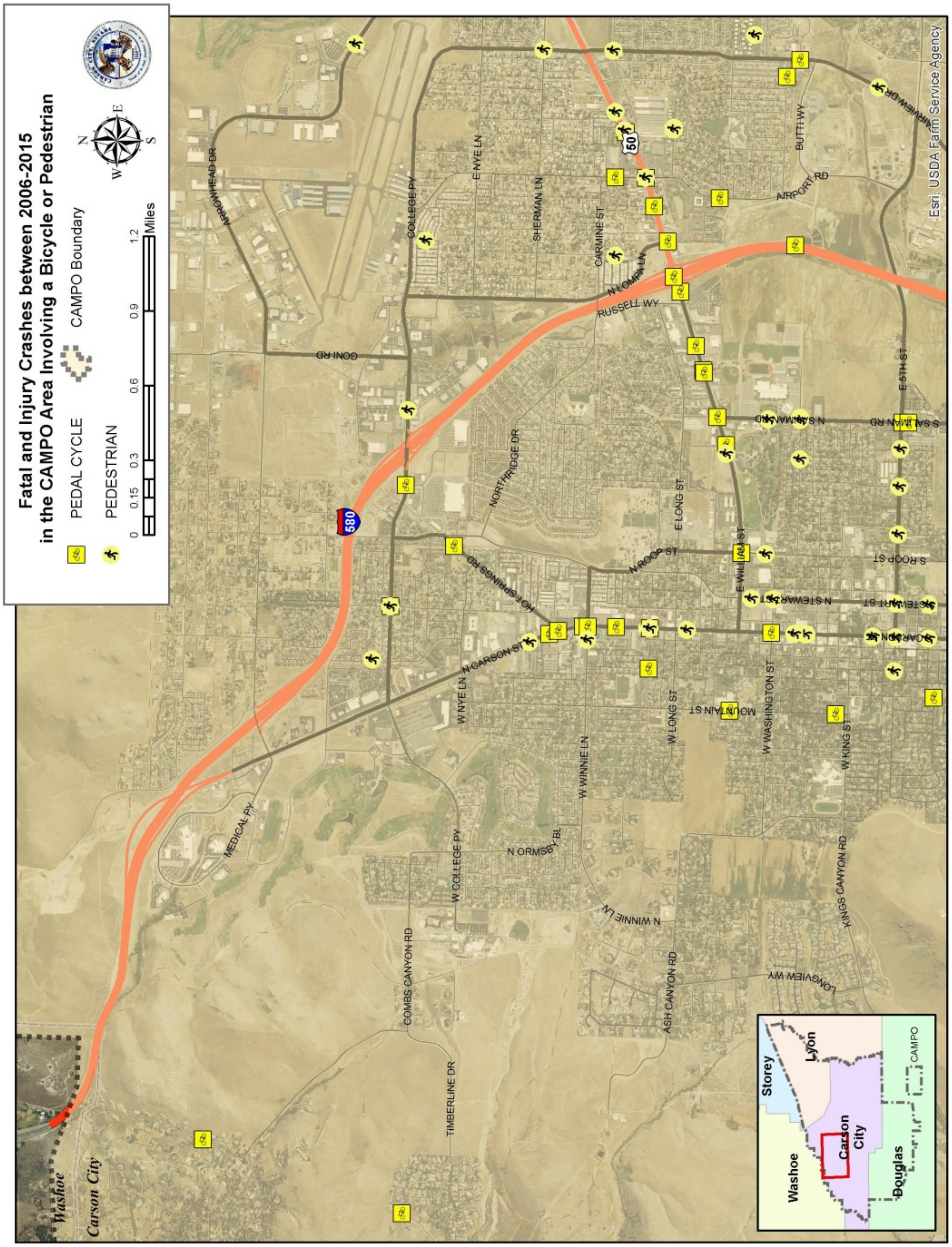


Figure 5.9 South Carson City Crashes involving a Bike or Pedestrian 2006-2015

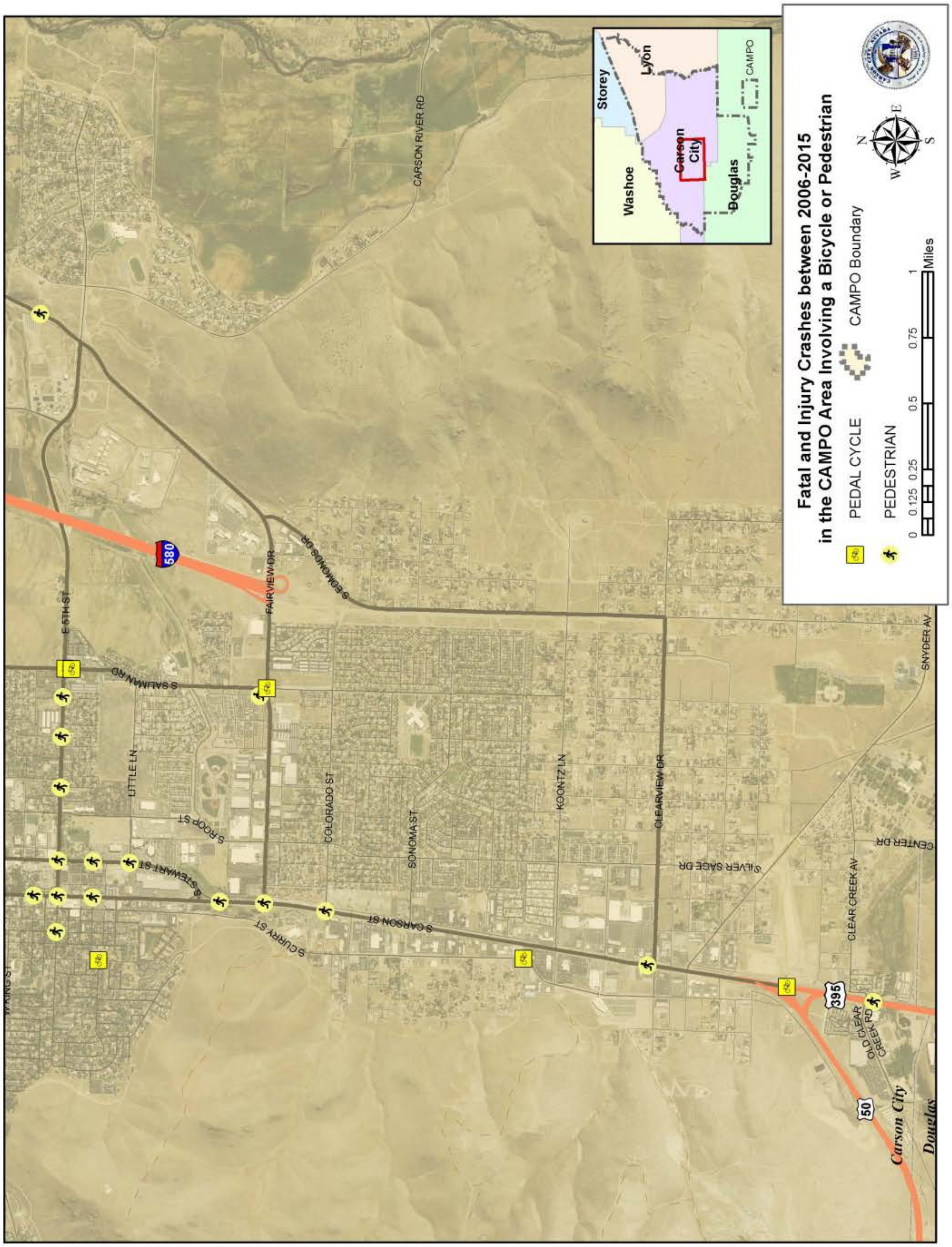
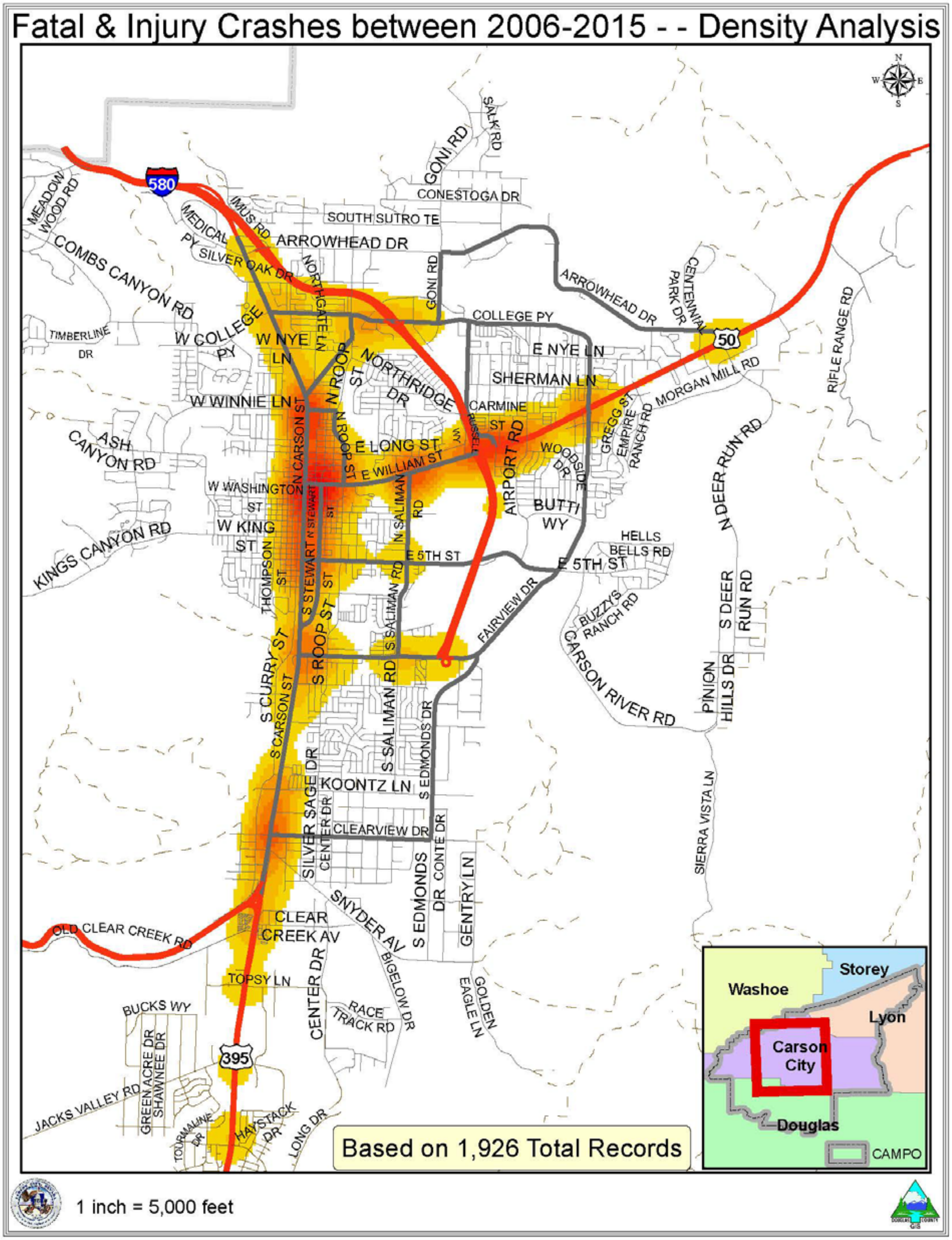


Figure 5.10 Carson City Density Map 2006-2015



Federal and State Programs

In 2010, the Nevada Department of Transportation (NDOT) adopted a Zero Fatalities goal. This goal is consistent with the national Toward Zero Deaths strategy sponsored by the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), and other national agencies and associations.

NDOT has recently approved the **2016-2020 Strategic Highway Safety Plan** (SHSP). The plan identifies highway traffic crashes as one of the nation's leading causes of death. The plan identified six Critical Emphasis Areas (CEAs) that were associated with a relatively high number of fatalities. The six CEAs are impaired driving, lane departures, seat belts, pedestrians, and intersections.

* The 2016-2020 Strategic Highway Safety Plan is available at the following link:
https://nevadadot.com/About_NDOT/NDOT_Divisions/Planning/Traffic_Safety_Engineering/Nevada_Strategic_Highway_Safety_Plan.aspx

The Nevada Strategic Highway Safety Plan 2016-2020 tracks the following additional objectives:

- Reduce the number of impaired driving-related fatalities and serious injuries
- Reduce the number of intersection-related fatalities and serious injuries
- Reduce the number of fatalities and serious injuries due to leaving the roadway
- Reduce the number of fatalities and serious injuries due to motorcycle-related crashes leaving the roadway
- Reduce the number of fatalities and serious injuries related to unprotected occupants
- Reduce the number of pedestrian fatalities and serious injuries

Chapter 6: Transportation System Resiliency

This chapter provides information on how climate change and extreme weather events can affect the transportation system. This transportation plan does not create any regional or local laws, but rather rasies awarness of how climate change and severe weather events will affect regional transportation.

In response to federal direction, transportation plans are expected to identify the risks of climate change and extreme weather events to current and planned transportation systems. Climate change and extreme weather events present significant and growing risks to the safety, reliability, effectiveness, and sustainability of the Nation's transportation infrastructure and operations.

The impacts of a changing climate (such as higher temperatures and changes in seasonal precipitation) and extreme weather events (such as intensity of rain events) are affecting the lifecycle of transportation systems. For example, inland flooding from unusually heavy downpours can disrupt traffic, damage culverts, and reduce service life. High heat can degrade materials, resulting in shorter replacement cycles and higher maintenance costs.

While transportation infrastructure is designed to handle a broad range of impacts based on historic climate, preparing for climate change and extreme weather events is critical to protecting the integrity of the transportation system and the sound investment of taxpayer dollars.

The FAST Act expands the focus on the resiliency of the transportation system as well as activities to reduce storm water runoff from transportation infrastructure. In addition, it requires strategies to reduce the vulnerability of existing transportation to natural disasters.

The following stressors can be evaluated through pavement management system software, this application is able to identify different distresses in pavement, some of which are caused by servere climate changes. Pavement management software helps agencies to preserve infrastructure and reduce vulnerability by appropriately timing maintenance treatments.

Asset Sensitivity

At the request of the Federal Highway Administration (FHWA), a Sensitivity Matrix was developed to help agenices identify which assets are at risk and from what climate stressors. The matrix was developed by the International Finance Corporation (IFC). The complete matrix can be found at http://www.fhwa.dot.gov/environment/climate_change/adaptation/tools/. The following stressors are considered to be possible for the Carson Area:

Increased Temperatures and Extreme Heat

Impact on Infrastructure

Paved Roads (Surface and Subsurface) - Sustained high temperatures can cause asphalt concrete pavement to soften resulting in rutting and shoving. Concrete pavement can heave at the joints. When high heat is accompanied by drought conditions, asphalt concrete pavement can crack making it more vulnerable to water when it does rain. Asphalt binder is designed to withstand temperatures up to a certain threshold. Incremental temperature increases up until that point is not likely to cause much damage. Thresholds vary depending on pavement design. Pavement binder may exhibit sensitivity beginning at 108°F, particularly if combined with truck traffic. Although aggregate is not sensitive to temperature, it can influence the sensitivity of the overall hot mix asphalt paving. For example, more aggregate that is angular may help to prevent rutting, which can result from high temperatures. During extreme heat spells when the temperature can remain above 100°F, with relatively little cooling at night, the pavement can soften. Areas with high truck traffic (particularly areas where trucks stop) can experience shoving during heat spells. Damage can be particularly bad in areas where trucks stopped, since the force of stopped "shoved" the soft pavement and caused damage. During a heat wave in July 2000, three lanes on Interstate 80 in the San Francisco Bay Area buckled due to thermal expansion, shutting down the freeway.

Unpaved Roads – No documented relationship.

Impact on Service, Access, Maintenance, and Operations

Stormwater Drainage (Culverts, Side Drains, etc.) - No documented relationship.

Signals and Signs - No documented relationship.

Road Work and Maintenance, Driver Safety, and Traffic and Service - High temperatures can increase health and safety risk as well as engine and equipment heat stress for road maintenance, truck operations, bus operations, private vehicles, and public vehicles. Risk of an accident increases with increasing extreme heat conditions (most likely due to slowed reaction time or loss of concentration or alertness). The largest increase was found to be in the category of single-vehicle accidents. Health and safety risk as well as possible engine/equipment heat stress begins at around 85°F, but the situation becomes more critical at 105-110°F. Restrictions limiting the number of hours that road crew maintenance can work begin at 85°F. At 110°F, operations are generally restricted.

Drought

Impact on Infrastructure

Paved Roads (Surface and Subsurface) - Droughts can contribute to cracking and splitting of pavements. As the ground beneath the roadway dries beyond normal ground moisture levels, droughts can cause pavement to crack as the ground shrinks beneath the asphalt.

Unpaved Roads – On gravel roads, dusty conditions occur when a disturbed road surface has dried out. Soil fines can actually shrink due to moisture loss, which, in turn, loosens and weakens the soil surface. A gravel road surface may lose one inch of material per year from dusting. Lack of moisture will encourage washboard formation and prolonged dry weather can aggravate the problem. This is because the crust that forms on the surface of a good gravel road will tend to loosen in dry weather. This allows the stone and sand-sized particles of gravel to "float" and the material can easily align itself into the washboard pattern under traffic.

Impact on Service, Access, Maintenance, and Operations

Stormwater Drainage (Culverts, Side Drains, etc.) - Sedimentation in culverts can occur during periods of low flow.

Certain culvert installations may encounter sedimentation problems. The most common of these are multibarrel installations and culverts built with depressions at the entrance. Culverts with more than one barrel may be necessary for wide shallow streams and for low fills. It is well documented that one or more of the barrels will accumulate sediment, particularly the inner barrel in a curved stream alignment. It is desirable for these installations to be straight and aligned with the upstream channel. Culverts built with an upstream depression possess a barrel slope, which is less than that of the natural channel.

Signals and Signs - No documented relationship.

Road Work and Maintenance, Driver Safety, and Traffic and Service - Dry conditions leading to the movement of dust from gravel roads can cause off-site damage, be a health hazard to humans, wildlife and plant life, or become a traffic safety hazard.

Wildfires

Impact on Infrastructure

Paved Roads (Surface and Subsurface) – Typical asphalt mixtures have the potential to ignite during tunnel fires. Experimental study found that samples of typical road surface asphalts ignited between 480 and 530°C. Further investigation observed some degradation of the asphalt at temperatures as low as 300°C. Even without igniting the bituminous mixtures, high temperatures can lead to excessive softening of pavements. For concrete, aggregates begin to expand by 600°C. This results in internal stresses that initiate the disintegration of the concrete. Concrete pavements are non-combustible and more resistant to fire than bituminous mixtures, but can still experience expansion at around 600°C.

Debris flows following wildfires can flood and damage roads.

Unpaved Roads – Debris flows following wildfires can flood and damage roads.

Impact on Service, Access, Maintenance, and Operations

Stormwater Drainage (Culverts, Side Drains, etc.) - Wildfires can denude hillslopes of vegetation and change soil properties that affect watershed hydrology and sediment-transport processes. Even small post-wildfire rainstorms can increase overland runoff that erodes soil, rock, ash, and vegetative debris from hillslopes. This increased runoff concentrates in stream channels and entrains the sediment that can lead to the generation of destructive debris flows. Post-fire debris flows can exert great impulsive loads on objects in their paths, block drainage ways, and damage structures.

Signals and Signs – No documented relationship.

Road Work and Maintenance, Driver Safety, and Traffic and Service - Smoke from fires fueled by drought caused low enough visibility to close highways and airborne dust has been a factor in major traffic accidents. There can be road closures due to fire threats or reduced visibility from smoke. Generally only a problem when visibility is under ¼ miles; low visibility can affect all sectors of surface transportation.

Precipitation-Driven Inland Flooding

Impact on Infrastructure

Paved Roads (Surface and Subsurface) – Flooding at waterway crossings (where water has velocity) can cause pavement and embankment failure, which begins when the water is high enough to flow over the roadway surface. Heavy precipitation and flooding can erode paved road surface. Over time, precipitation can worsen existing pavement damage (for example, from cracking due to temperature impacts). During heavy precipitation events, rain can leak in under the pavement and damage the subgrade, which is very sensitive to moisture levels. The sensitivity of pavements depends on the type of pavement design. Thin bituminous pavements are more sensitive to water than other types, if moisture breaches the subgrade from the pavement shoulder; it deforms the subgrade, which is then subjected to high stress loads during traffic. Some of the common damage from moisture includes: surface defects, surface deformations, and cracking. If the pavement is completely submerged, the water may begin to infiltrate the subgrade. If this happens multiple times, it will damage the pavement, particularly if the road has high traffic loads as well. Paved roads begin to experience damage at around a 50-100 year storm.

Unpaved Roads – Heavy precipitation events often wash out unpaved roads. While unpaved roads are more susceptible to damage during flooding events, they are cheaper to fix. Unpaved surface is more sensitive than paved roads to low levels of damage resulting from flooding.

Impact on Service, Access, Maintenance, and Operations

Stormwater Drainage (Culverts, Side Drains, etc.) - Heavy precipitation events can cause debris accumulation, sedimentation, erosion, scour, piping, and conduit structural damage. Damage generally does not occur until around a 50-100 year storm.

Signals and Signs – Even light rain slows traffic and decreases the capacity of a road to handle traffic. Rain increases safety risk on the road by impairing visibility, mobility, and increasing the likelihood of hydroplaning. Under very light rain conditions, road capacity may be reduced by 1-3%. Under light rain conditions, capacity may be reduced by 5-10%. Similarly, measured roadway speed decreases 1-2% under very light rain, 2-4% under light rain, and 4-7% under heavy rain.

Road Work and Maintenance, Driver Safety, and Traffic and Service - No documented relationship.

Wind

Impact on Infrastructure

Paved Roads (Surface and Subsurface) – Minimal Impact

Unpaved Roads – Minimal Impact

Impact on Service, Access, Maintenance, and Operations

Stormwater Drainage (Culverts, Side Drains, etc.) - Wind damages trees, buildings, and other structures. Debris from this destruction can clog the stormwater drainage system, resulting in flooding impacts to the surrounding area.

Signals and Signs - Winds can blow over highway, street, and road signs. If street signs (such as stop signs) are not buried deeply in strong soils, they may not comply with design standards and may fail at (much) lower wind speeds.

Road Work and Maintenance, Driver Safety, and Traffic and Service - High winds cause safety risks and travel delays, a loss of visibility, impaired mobility, loss of communications and power, freight/cargo damage risk, increased risk of collisions/spills of hazardous cargo, and transport schedule delays.

Winds become dangerous to road maintenance, truck operations, and other road users at around 39 mph and are very dangerous at 74 mph. The American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) wind load provisions assume that no traffic will be present on a bridge when wind speed exceeds 56 mph.

Highway operations experience the following impacts during conditions with winds of above 74 mph: safety risks, loss of life, loss of visibility, loss of traction, loss of communications and power, and road damage. Milder impacts may also be experienced at winds less than 74 mph.

Changes in Freeze/Thaw

Impact on Infrastructure

Paved Roads (Surface and Subsurface) - Changes in freeze thaw affect different types of paving in different ways. There are many complexities to the way that asphalt cement is blended, and some asphalt binders respond better to freeze thaw cycles than others. Additionally, the volume and spacing of air voids in the aggregate mix has an effect on how susceptible an asphalt roadway is to freeze/thaw. The basic challenge with freeze/thaw cycles and concrete and asphalt is that water on the roadway seeps into cracks that are caused by normal wear and tear from cars, and during freeze and thaw cycles, the water freezes, which increases pressure underneath the pavement surface, and then melts as the temperatures warm. When the water freezes and pressure increases, the asphalt in particular rises up into a small bubble. As the temperature warms and the ice melts, the asphalt "bubble" is unsupported, and cars driving over it cause it to weaken and collapse into the hole beneath it. This is what is known as a pothole. This same phenomenon also causes additional surface cracks, deformations, and wheel ruts.

One threshold that can be used to look at this relationship is the number of freeze/thaw cycles. One study looked at the effect that 0, 6, 12, 18, and 24 days of freeze thaw cycles have on the engineering properties of asphalt concrete. The researchers found that as the number of day's increases, asphalt cement has an exponentially lower Marshall Stability value. Marshall Stability measures the maximum load sustained by the asphalt material.

Unpaved Roads – No documented relationship.

Impact on Service, Access, Maintenance, and Operations

Signals and Signs - No documented relationship.

Road Work and Maintenance, Driver Safety, and Traffic and Service - Potholes, cracks, and rutting in the road surface result in increased maintenance costs and present a safety risk to drivers. During the colder months in some parts of the world, frozen subgrades in the roadway can provide a more solid road foundation for heavy vehicles. However, as the thaws begin, or as the number of cycles increases, the road surface becomes more susceptible to cracking and potholes. The number of new potholes after a winter season (particularly one with many freeze/thaw cycles) can number into the tens of thousands per year in a large city. The City of Tulsa, for example, made over 70,000 temporary pothole repairs in 2010.

Winter Storms

Impact on Infrastructure

Paved Roads (Surface and Subsurface) - Some of the challenges from winter storms lie in increased freeze/thaw cycles as discussed above.

Unpaved Roads - Snow and/or ice accumulation on gravel or dirt roads is more challenging to manage and clean up than on paved roads. Furthermore, as snow and ice melt, especially on gravel roadways, car wheels can push gravel and dirt out of their most functional formations, which requires maintenance. However, gravel and dirt roads while frozen hold up relatively well to vehicular traffic.

Impact on Service, Access, Maintenance, and Operations

Signals and Signs - The majority of the winter storm impacts on roadways are related to roadway service. Winter storms bring heavy snowfall or freezing rain, and are often accompanied by strong winds. These impacts affect operational infrastructure, rather than the road surface. High winds and heavy precipitation can cause power outages that render traffic lights and overhead streetlights useless.

Road Work and Maintenance, Driver Safety, and Traffic and Service - The snowfall, wind, and reduced visibility brought by winter storms have a significant effect on roadway operations and roadway use. In particular, winter storms affect driver behavior, vehicle capacity, crash risk, and agencies' capabilities to perform emergency maintenance and other responsibilities. Several studies have looked at the effect that winter storms have on travel time and traffic speed, and have found that winter storms result in significant reductions in traffic speed and increases in traffic delay. Another major challenge related to winter storms is the increase in precipitation and decrease in visibility that can affect driver safety. Drivers have less control over their vehicles during winter storms (due to slick roadways, windy conditions, and reduced visibility), which increases crash risk. Finally, winter weather presents a significant cost to transportation agencies. FHWA's highway statistics publication shows each year, state and local transportation agencies spend $2.3 billion on snow and ice removal, accounting for 20% of their annual transportation budgets.

Chapter 7: The Planning Process

Development of the CAMPO 2040 Regional Transportation Plan involved public presentations to the CAMPO Board, two public planning meetings, two Bicycle and Pedestrian Advisory Workgroup meetings, and an online survey. CAMPO staff employed new strategies in an effort to increase public participation. The survey and associated advertisements proved to be beneficial in achieving a higher level of public participation.

Public outreach greatly benefits the Regional Transportation Plan process; it allows staff to gain insight on how the public perceives current transportation-related issues. Among other topics, the survey indicated the Carson area residents *strongly agree* that the local and regional transportation system impacts their quality of life. CAMPO staff sought input from other agencies such as the Nevada Department of Transportation, the Federal Highway Administration, and the Federal Transit Administration, specifically in developing performance measures.

Planning Meetings for the Regional Transportation Plan

The CAMPO staff used three types of meetings to solicit comments regarding the regional transportation plan. Public planning meetings, held at the Carson City Community Center, were held as an informal open house meeting, intended for the public for staff to present information and to solicit comments and questions. The second type of meeting was the monthly CAMPO Board meetings. These meetings were used to present information to the CAMPO Board and to the public. The third type of meeting was CAMPO's quarterly Bicycle and Pedestrian Advisory Workgroup, comprised of regional stakeholders aimed at coordinating bike and pedestrian efforts. A summary of these meetings is provided below:

Public Planning Meetings (Open house format)

- October 20, 2015, 4:00 to 6:00 pm – Public planning kick off meeting to introduce the development of the Regional Transportation Plan and solicit public comment
- February 25, 2016, 4:30 to 6:30 pm – Public planning meeting to present results from the online survey, travel demand model and crash data analysis. Additionally, bike map exhibits were displayed. Public comment and questions were solicited.

CAMPO Monthly Meetings

- October 14, 2015 – Staff updated CAMPO Board on plan development and introduced survey
- March 9, 2016 – Staff updated the CAMPO Board on the status of the plan and presented results from the travel demand model and the analysis of crash data.

Bicycle and Pedestrian Advisory Workgroup Meeting

- November 23, 2015 – provided stakeholders an overview of the Regional Transportation Plan and solicited comments
- February 22, 2016 – provided stakeholders draft bike maps and solicited comments
- May 16, 2016 – presented final bike network maps and provided information on the status of the plan

The online survey helped to identify concerns and priorities for the Carson Area transportation system. The following bullets are notable highlights from the survey. Complete results from the survey are include later in this chapter

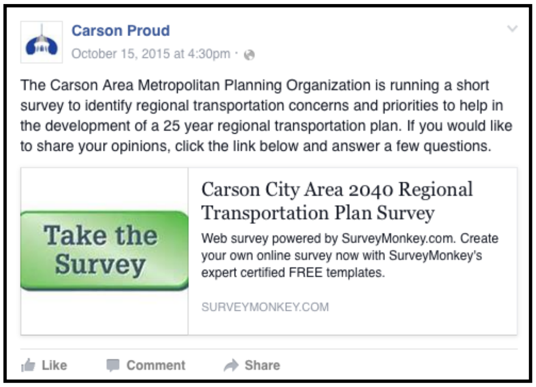
- Over 72% reported being very or somewhat concerned with cracks or potholes in the roadway
- Over 64% reported being very or somewhat concerned with sidewalks in poor condition
- Over 76% reported being very or somewhat concerned with driver behavior
- Of the seven options for spending money (Question 9) "repair existing roads" got the most allocation – 34%

Online Survey

Survey Promotion

CAMPO conducted a short online survey to identify regional transportation concerns and priorities to help in the development of this 20 plus year regional transportation plan. The survey was opened on October 6, 2015, and was closed December 21, 2015. The survey included 11 questions and 153 responses were collected. Staff advertised the survey in the Nevada Appeal and Record Courier (local newspapers), CarsonNOW (a local online news site), on the Carson Proud Facebook page (a local organization aiming to get residents involved), and on the CAMPO website. The following advertisements were used for the online survey:

Carson Proud



Carson Proud
October 15, 2015 at 4:30pm ·

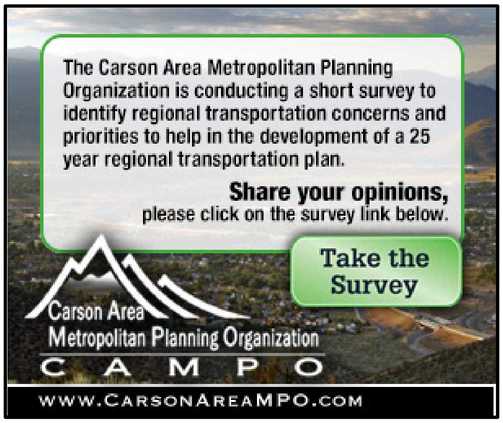
The Carson Area Metropolitan Planning Organization is running a short survey to identify regional transportation concerns and priorities to help in the development of a 25 year regional transportation plan. If you would like to share your opinions, click the link below and answer a few questions.

Carson City Area 2040 Regional Transportation Plan Survey

Web survey powered by SurveyMonkey.com. Create your own online survey now with SurveyMonkey's expert certified FREE templates.

SURVEYMONKEY.COM

Nevada Appeal



The Carson Area Metropolitan Planning Organization is conducting a short survey to identify regional transportation concerns and priorities to help in the development of a 25 year regional transportation plan.

Share your opinions,
please click on the survey link below.

Take the Survey
Carson Area
Metropolitan Planning Organization
CAMPO
WWW.CARSONAREAMPO.COM

CarsonNOW.org

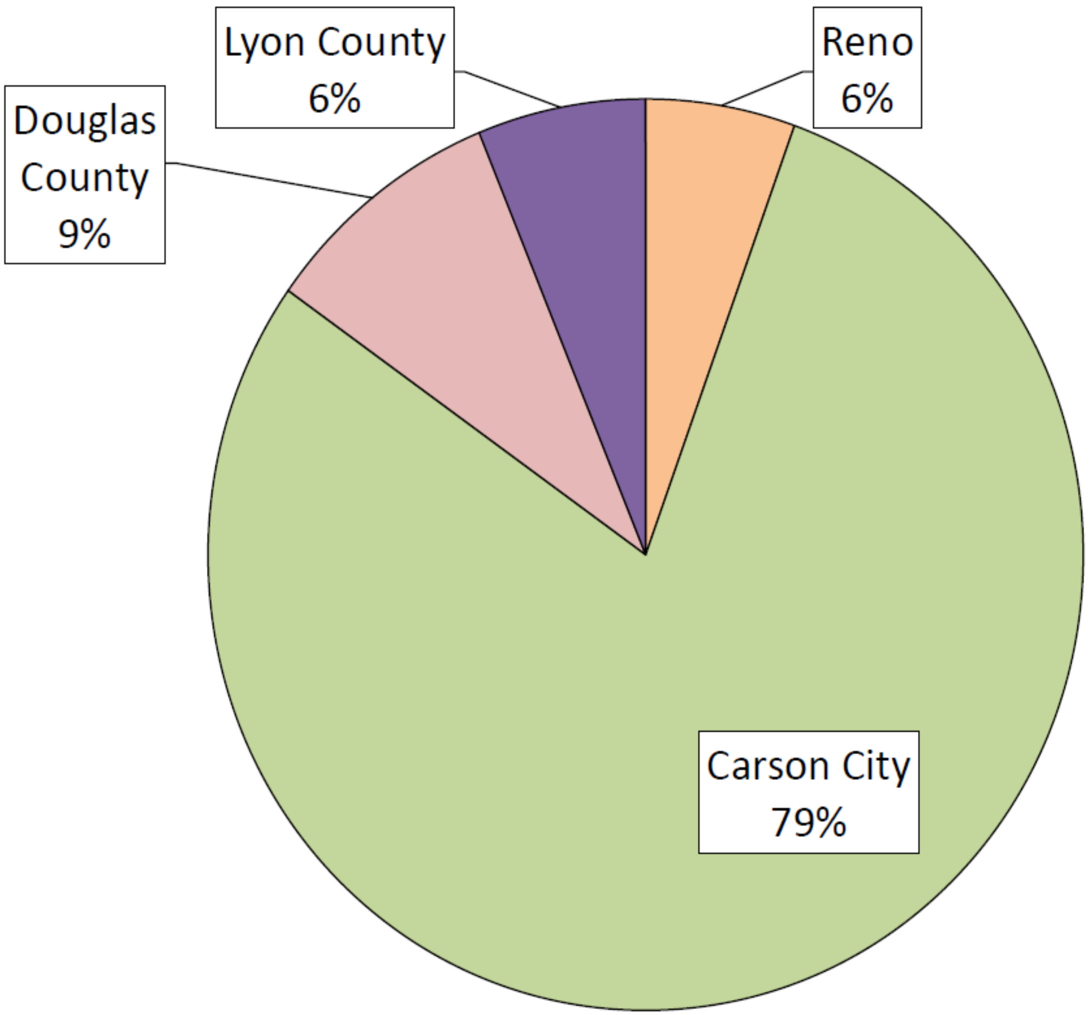
Carson Area Transportation...
what is your opinion?

Share your opinion on local and regional transportation to help in the development of a 20+ year regional transportation plan.

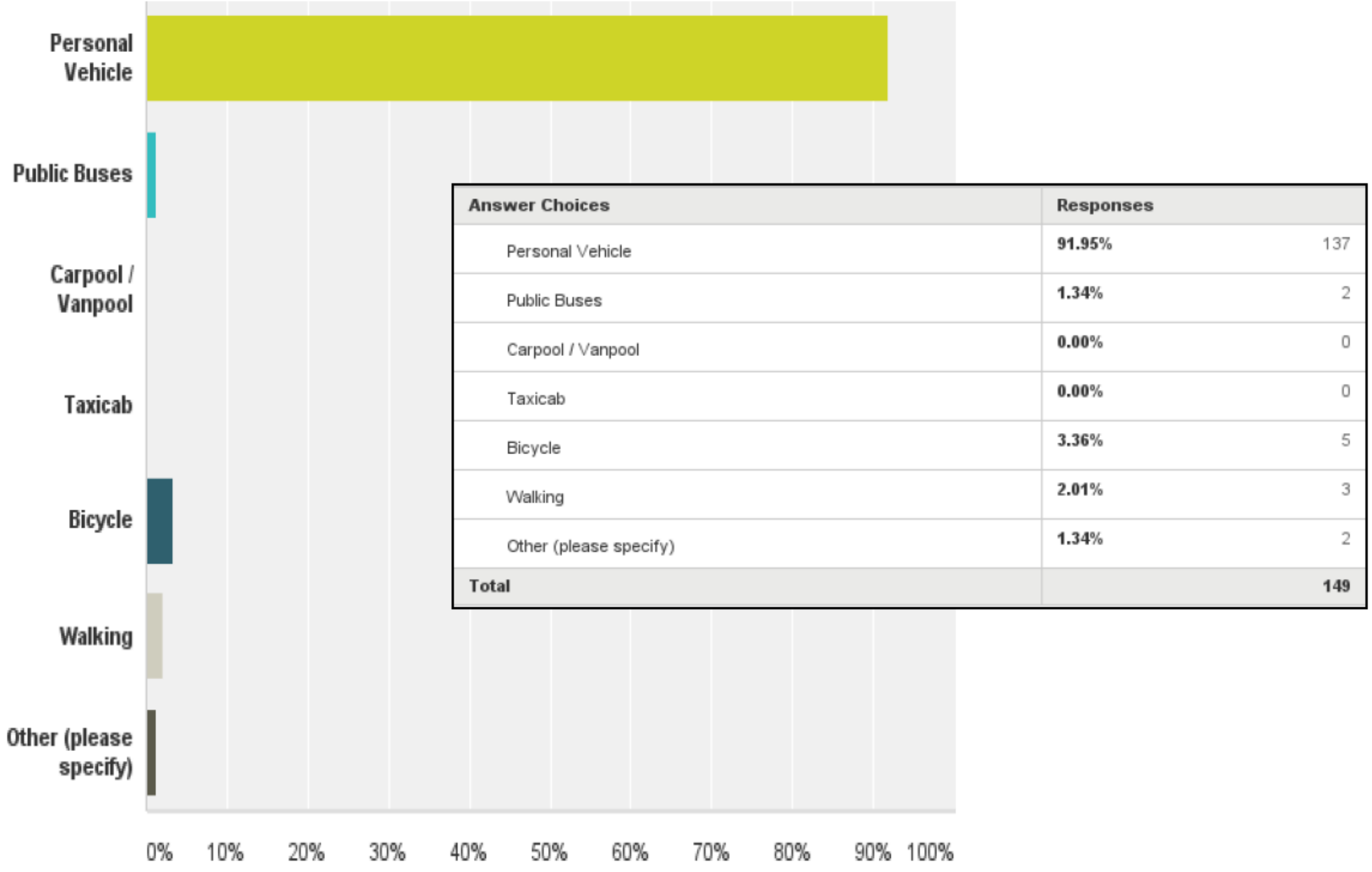
Carson Area
Metropolitan Planning Organization
CAMPO
Take The Survey

Survey Results

Question 1: In what ZIP code is your home located?

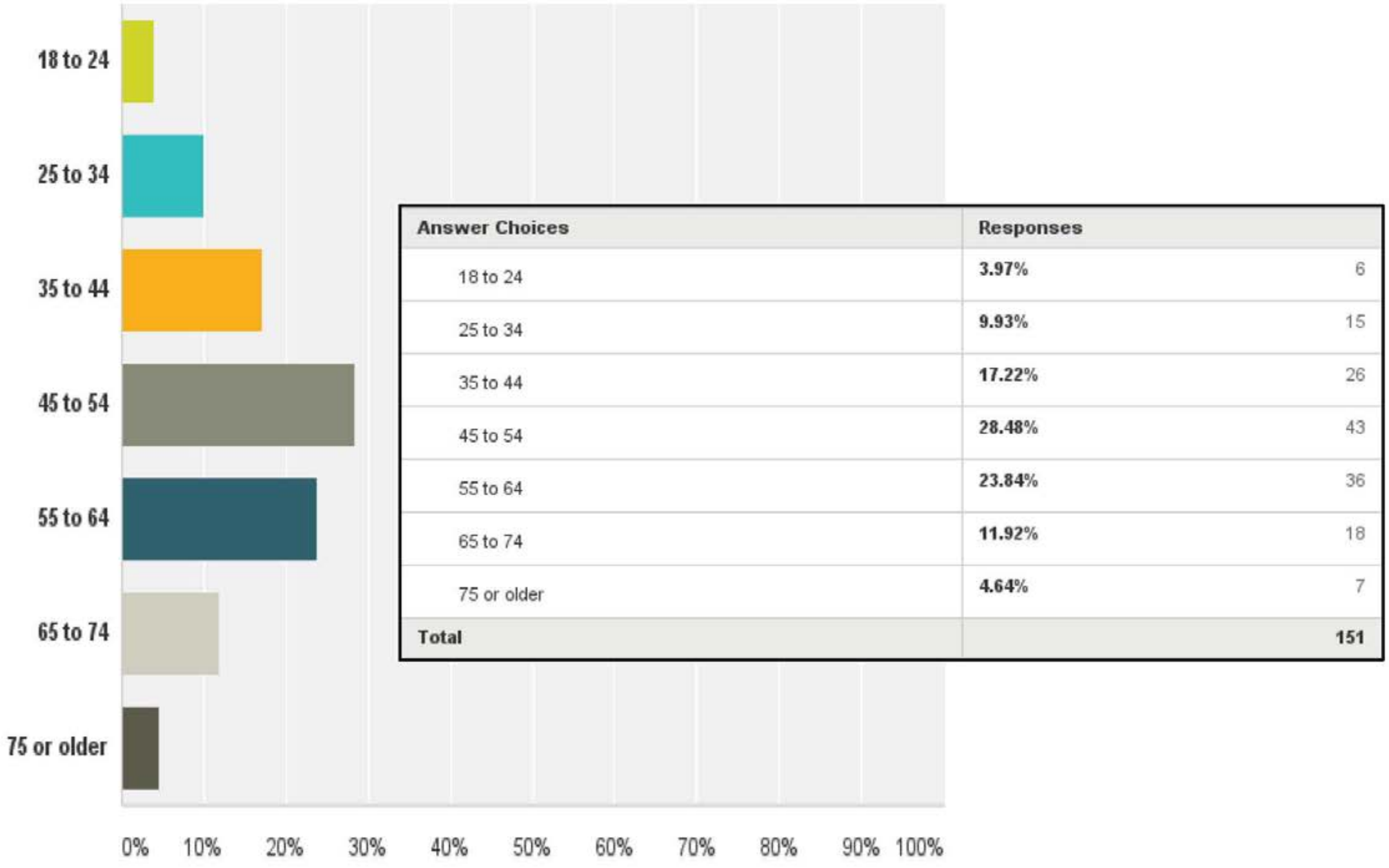


Question 2: What is your primary mode of transportation?



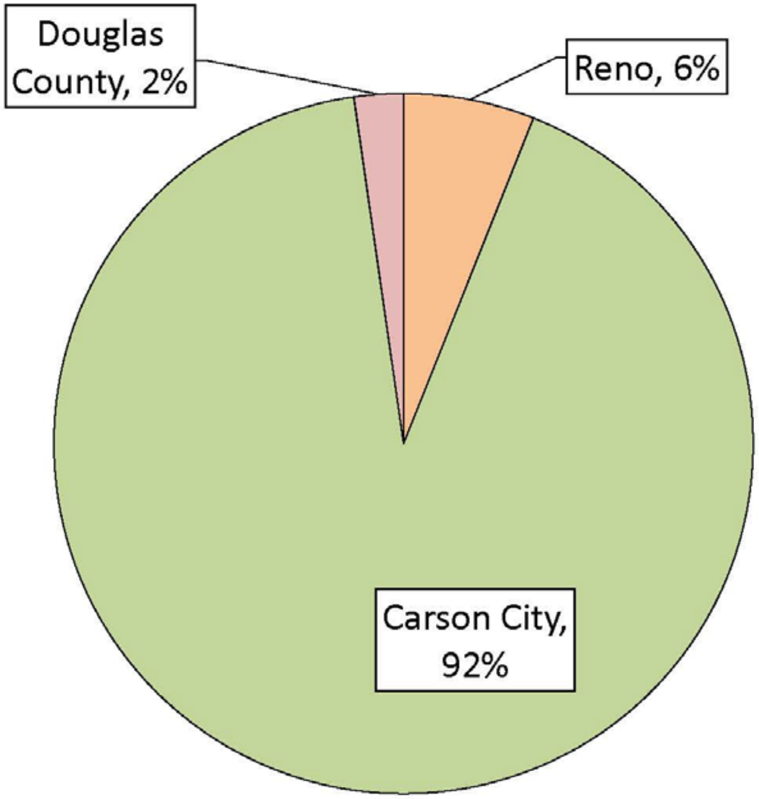
Answer Choices	Responses	
Personal Vehicle	91.95%	137
Public Buses	1.34%	2
Carpool / Vanpool	0.00%	0
Taxicab	0.00%	0
Bicycle	3.36%	5
Walking	2.01%	3
Other (please specify)	1.34%	2
Total		**149**

Question 3: What is your age?

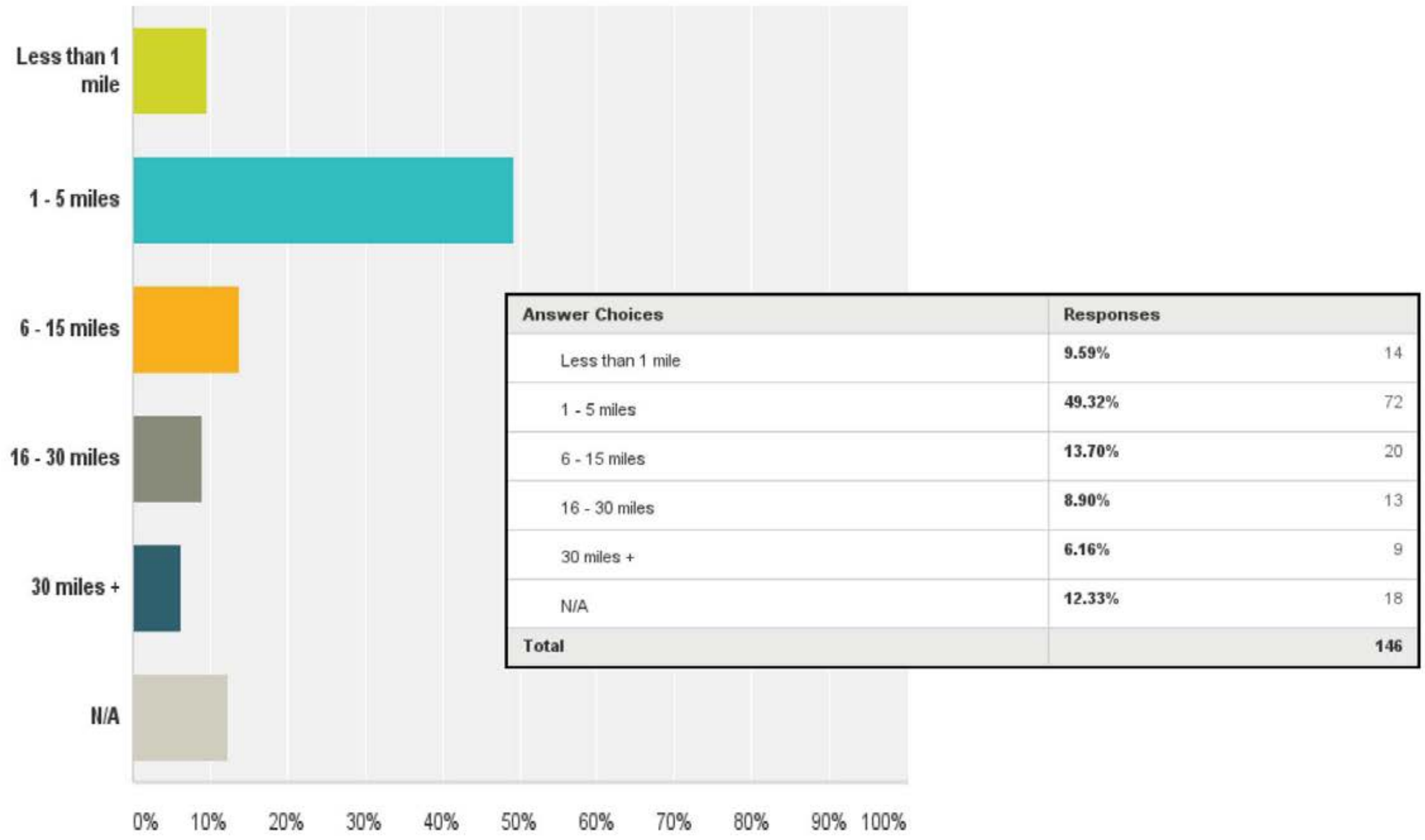


Answer Choices	Responses	
18 to 24	**3.97%**	6
25 to 34	**9.93%**	15
35 to 44	**17.22%**	26
45 to 54	**28.48%**	43
55 to 64	**23.84%**	36
65 to 74	**11.92%**	18
75 or older	**4.64%**	7
Total		**151**

Question 4: In what ZIP code is your workplace located?

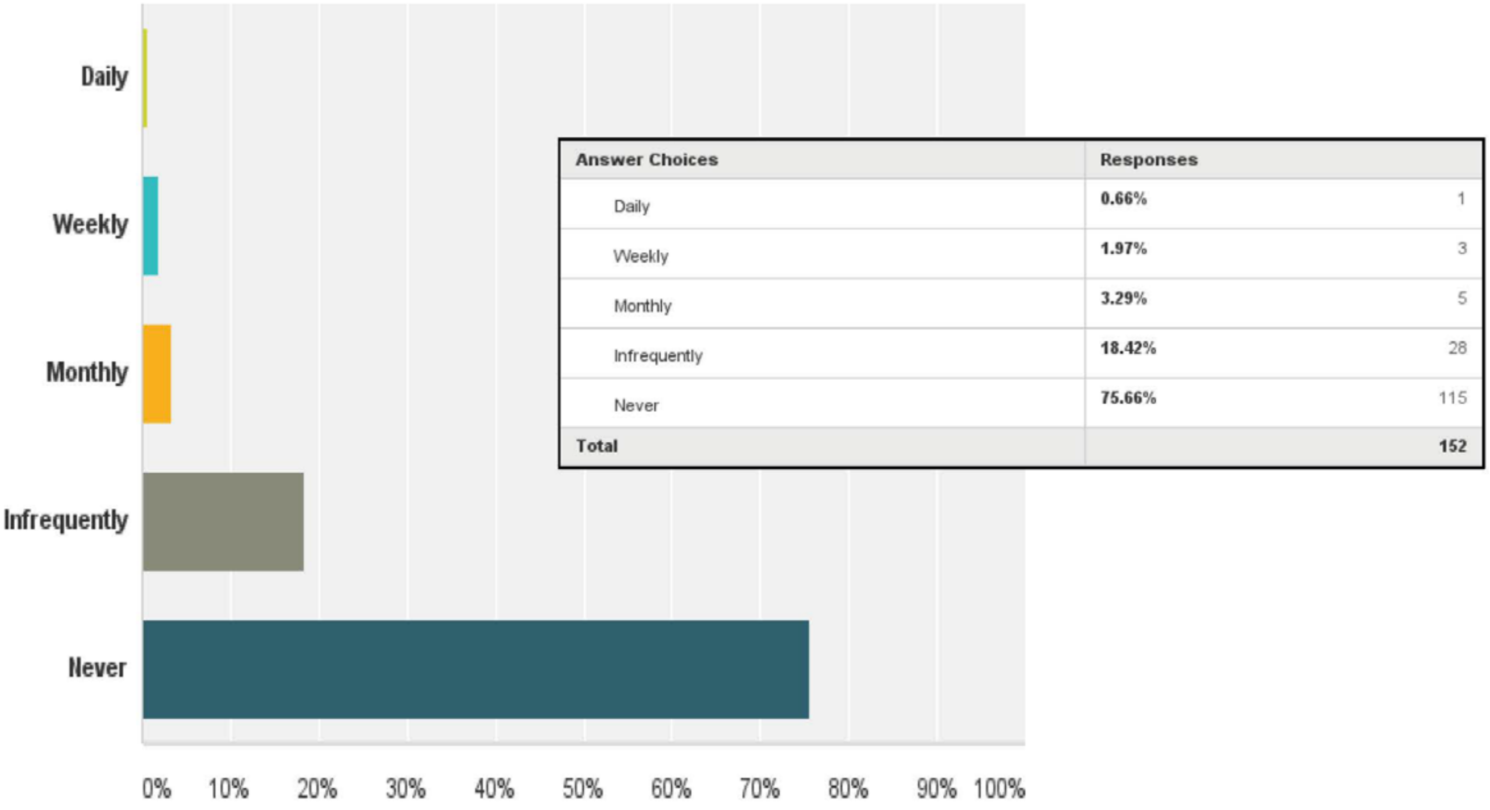


Question 5: How far is your commute to work/school?



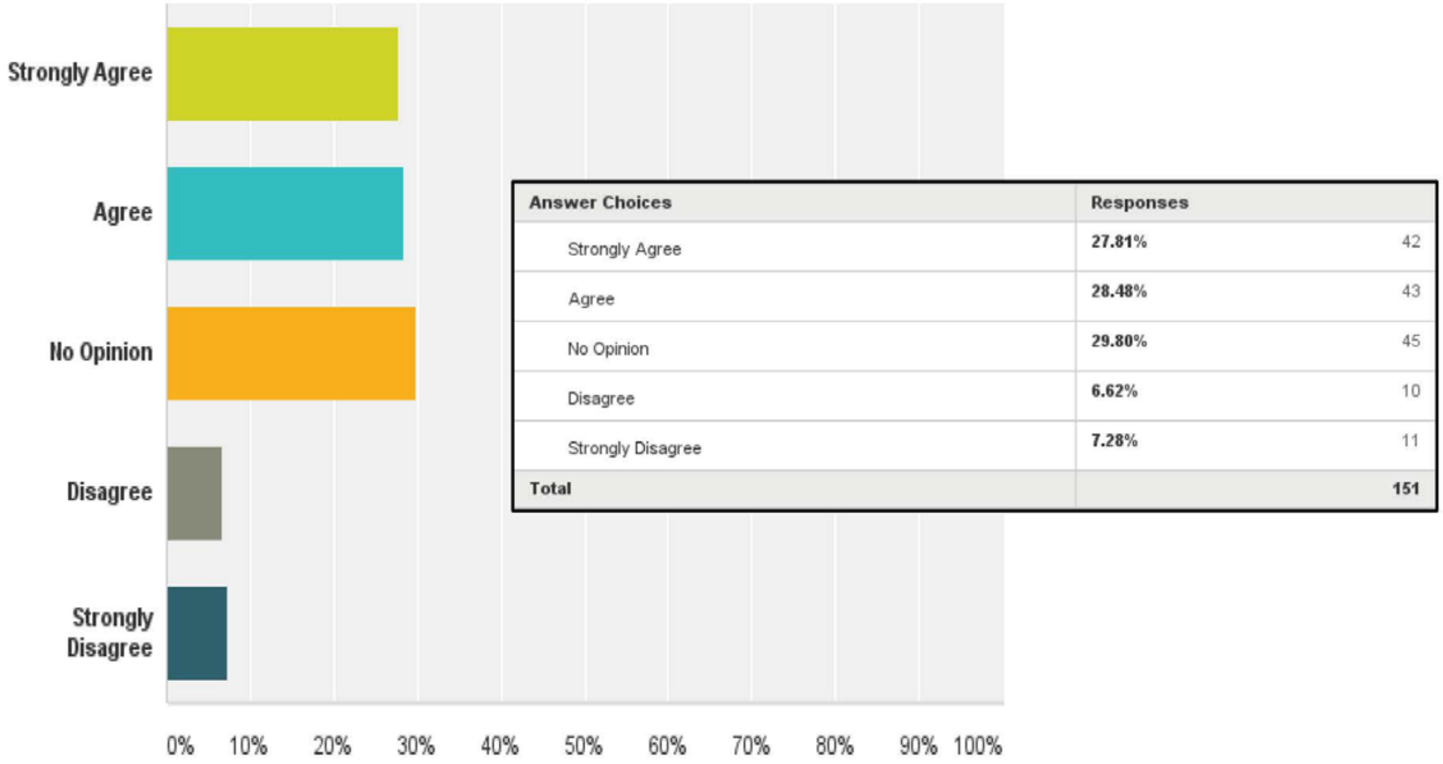
Answer Choices	Responses	
Less than 1 mile	9.59%	14
1 - 5 miles	49.32%	72
6 - 15 miles	13.70%	20
16 - 30 miles	8.90%	13
30 miles +	6.16%	9
N/A	12.33%	18
Total		146

Question 6: How frequently do you ride a public bus?



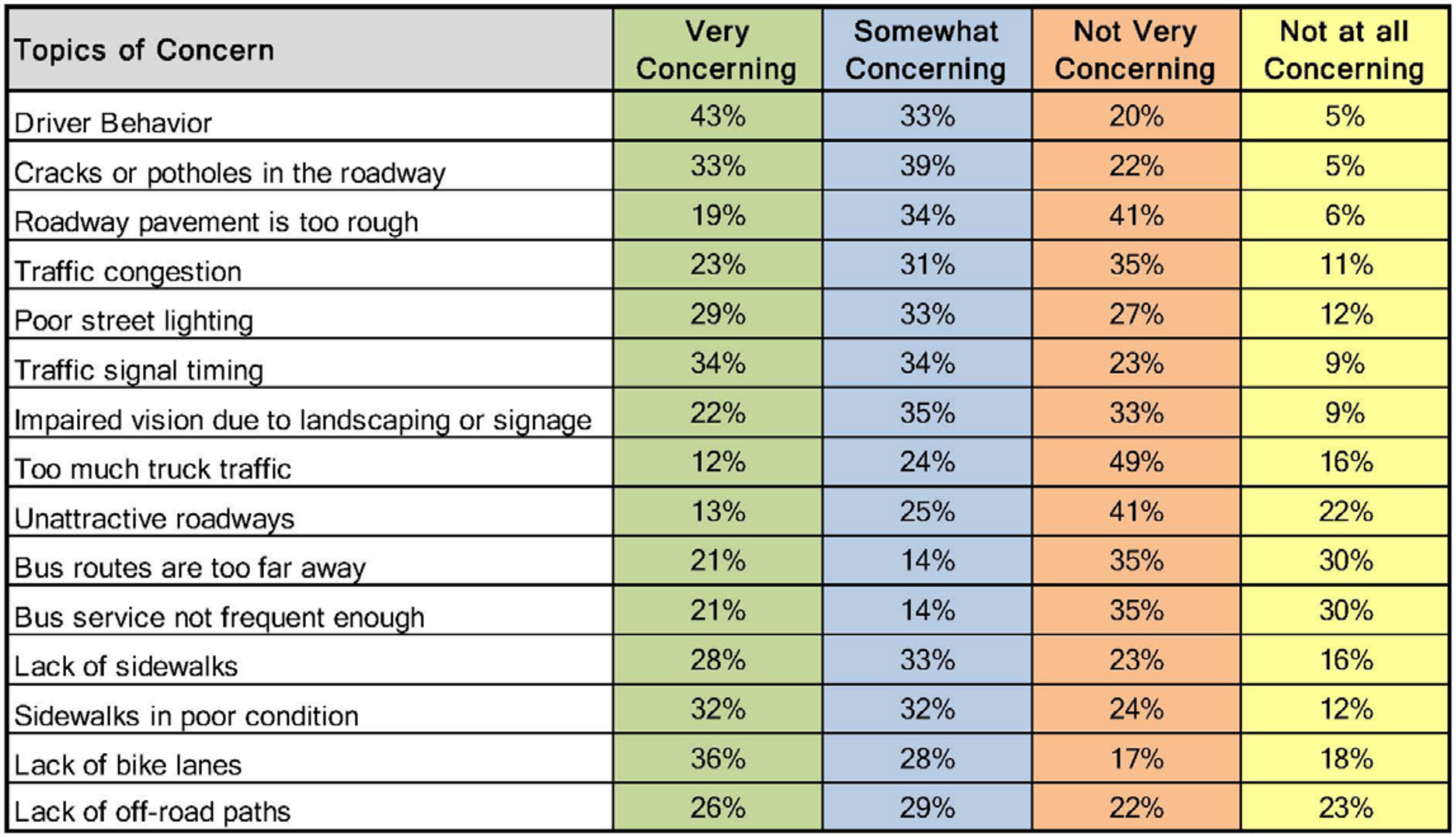
Answer Choices	Responses	
Daily	0.66%	1
Weekly	1.97%	3
Monthly	3.29%	5
Infrequently	18.42%	28
Never	75.66%	115
Total		**152**

Question 7: Do you feel that the local and regional transportation system impacts your quality of life?



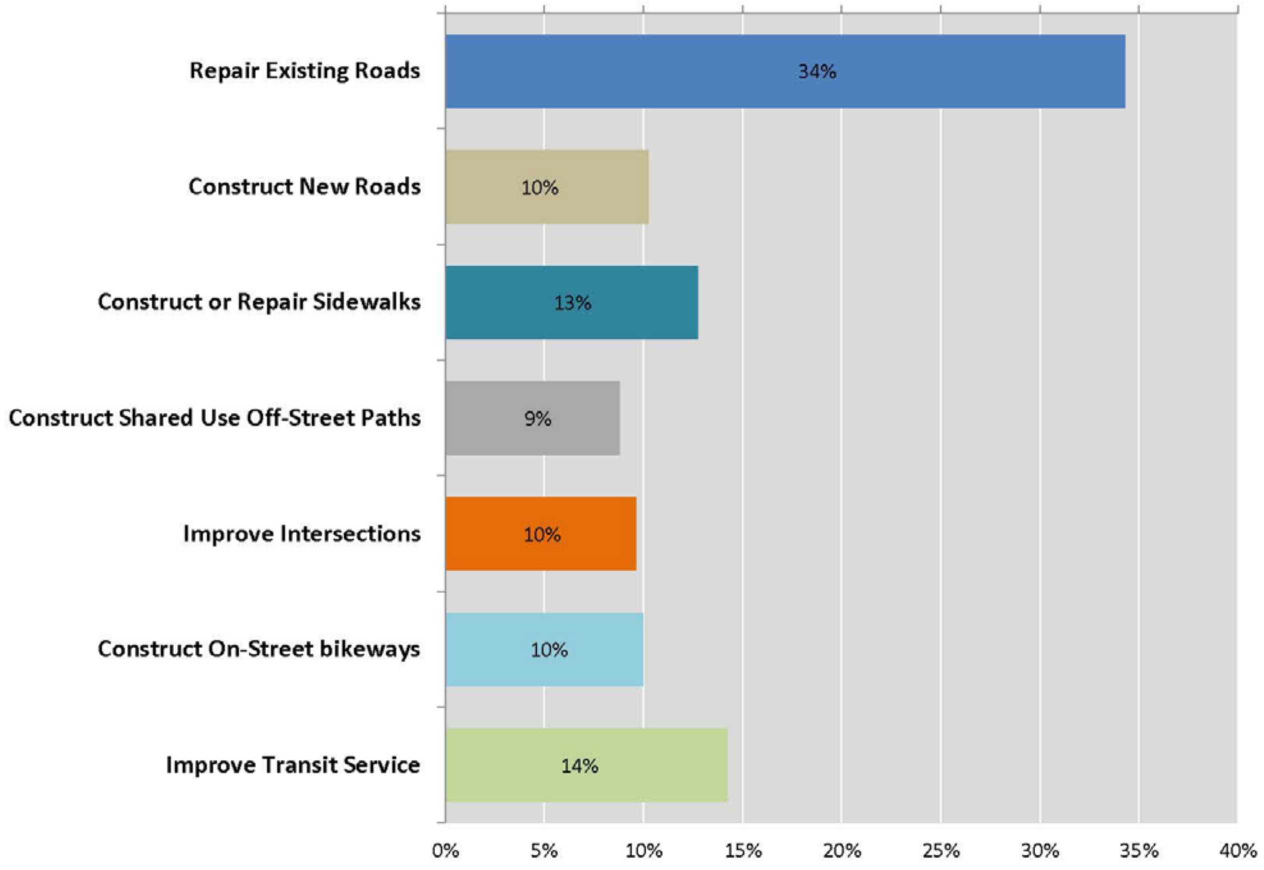
Answer Choices	Responses	
Strongly Agree	27.81%	42
Agree	28.48%	43
No Opinion	29.80%	45
Disagree	6.62%	10
Strongly Disagree	7.28%	11
Total		**151**

Question 8: When traveling in the Carson City area, which transportation issues concern you the most?



Topics of Concern	Very Concerning	Somewhat Concerning	Not Very Concerning	Not at all Concerning
Driver Behavior	43%	33%	20%	5%
Cracks or potholes in the roadway	33%	39%	22%	5%
Roadway pavement is too rough	19%	34%	41%	6%
Traffic congestion	23%	31%	35%	11%
Poor street lighting	29%	33%	27%	12%
Traffic signal timing	34%	34%	23%	9%
Impaired vision due to landscaping or signage	22%	35%	33%	9%
Too much truck traffic	12%	24%	49%	16%
Unattractive roadways	13%	25%	41%	22%
Bus routes are too far away	21%	14%	35%	30%
Bus service not frequent enough	21%	14%	35%	30%
Lack of sidewalks	28%	33%	23%	16%
Sidewalks in poor condition	32%	32%	24%	12%
Lack of bike lanes	36%	28%	17%	18%
Lack of off-road paths	26%	29%	22%	23%

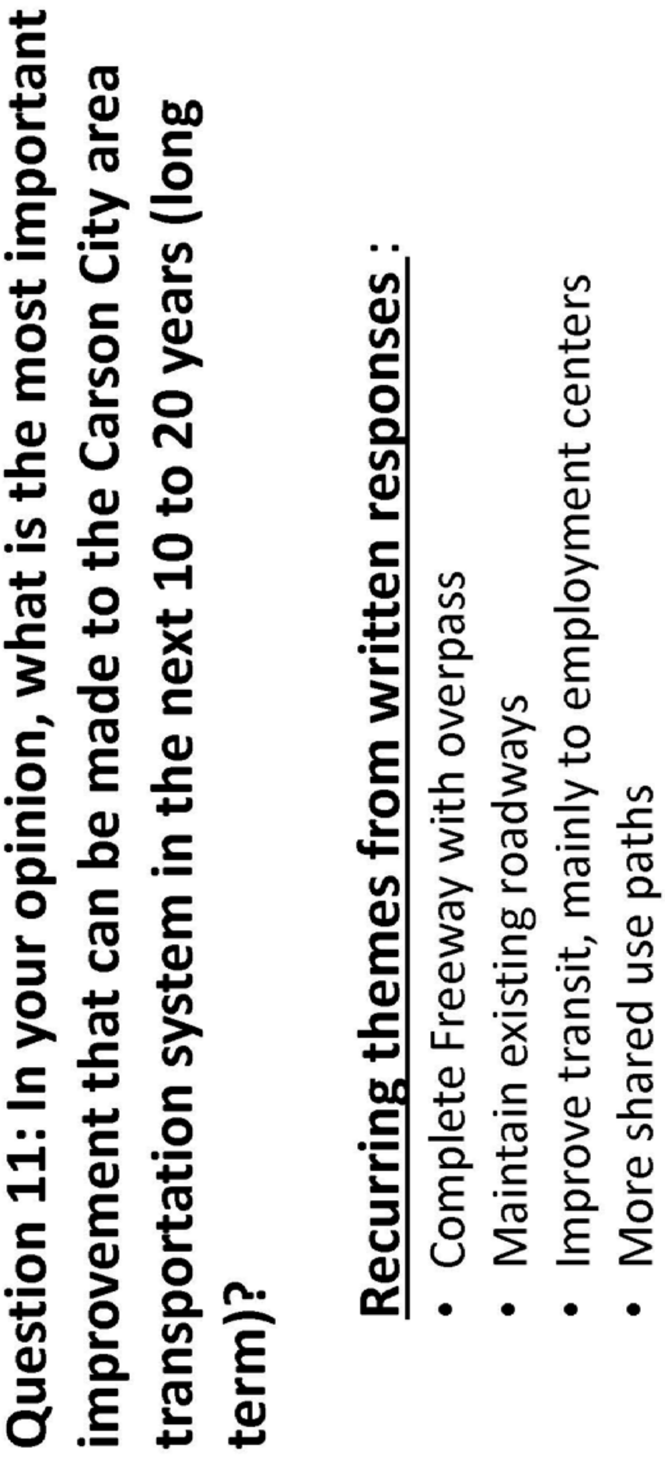
Question 9: What percentage of transportation resources would you allocate to the following transportation strategies?



Question 10: In your opinion, what is the most important improvement that can be made to the Carson City area transportation system in the next five years (short term)?

Recurring themes from written responses:

- Complete Freeway
- Roadway repair
- Lighting
- Improve connectivity for bikers and walkers
- Sidewalk repair
- Expand bus service
- Leave downtown alone
- Pedestrian safety
- Improve traffic signals
- Improve crosswalk



Question 11: In your opinion, what is the most important improvement that can be made to the Carson City area transportation system in the next 10 to 20 years (long term)?

Recurring themes from written responses :

- Complete Freeway with overpass
- Maintain existing roadways
- Improve transit, mainly to employment centers
- More shared use paths

Chapter 8: Transportation Technologies

The future of transportation will have a meaningful effect on society’s safety, pollution levels, movement of goods, and productivity. Intelligent technology systems, smart cars, autonomous vehicles, unmanned aerial vehicles, and the Hyperloop system are emerging technologies that will in some way impact the Carson area by the year 2040. Appropriately planning for these technologies and the influence they will have to our region is recommended.

Vehicle crashes, vehicle emissions, stormwater pollution from transportation facilities, and unproductive travel times are all realities of the Carson area transportation system. Some of the emerging technologies might not exist in the Carson area in the next 25 years, but they will still have an impact on our region and our quality of life.

Intelligent Technology Systems (ITS)

ITS includes a variety of technological engineering. Examples of ITS include timing of traffic signals to reduce congestion during peak travel times, remote metering to identify traffic volumes, remote or automated system controls so the transportation system can react to changing conditions, and system communication to improve emergency response time or to inform drivers of approaching conditions.

The primary benefits of ITS include creating a safer transportation system and reducing congestion. However, if autonomous vehicles continue to emerge, the infrastructure and software used in ITS may be mutually beneficial to the autonomous vehicle industry.

*More information is located here: http://www.its.dot.gov/strategicplan/ or http://www.govtech.com/transportation/How-Transportation-Technologies-Will-Change-Everything-.html.

Smart cars

Smart cars are commonly considered small compact cars; however, the term smart car is evolving. While being efficient is typically one aspect, new technology is being incorporated for safety. Smart car technology can include crash avoidance, night-vision enhancements, and automated communication technology, to communicate with the transportation network to inform the driver or notify emergency services. Manufacturers are already offering some of these technologies, while others are still in development.

*More information is located here: http://www.foxnews.com/tech/2013/11/27/five-future-transportation-technologies-that-will-actually-happen.html.

Autonomous vehicles

The autonomous vehicle is not a new concept; however, investment from manufacturers, research institutions, and governments has recently been growing. The State of Nevada has created public policy allowing the testing of autonomous vehicles on public roadways. The implications of autonomous vehicles to the transportation system, our economy, and our quality of life may be significant.

The key findings from a publication on autonomous vehicles are provided below:

Benefits of Autonomous Vehicles

- Without driver error, fewer vehicle crashes will result
- The mobility of the young, the elderly, and the disabled will be increased
- Traffic flow could be more efficient and congestion decreased
- Vehicle occupants could spend travel time engaged in other activities, so the costs of travel time and congestion are reduced
- Fuel efficiency can be increased and alternative energy sources facilitated
- Because such vehicles won't need proximate urban parking, space used for parking could be repurposed

Possible Drawbacks to Autonomous Vehicles

- Because the technology would decrease the cost of driving, congestion might increase, rather than decrease
- Occupations and economies based on public transit, crash repair, and automobile insurance might suffer as the technology makes certain aspects of these occupations obsolete

*More information is located here: http://www.rand.org/pubs/research_reports/RR443-2.html.

Unmanned Aerial Vehicles (UAV)

The technology of UAVs is being embraced by the State of Nevada. The use of UAVs in emergency response, infrastructure inspections, and product delivery is currently emerging. As this industry develops, transportation professionals will need to be mindful of this technology and its impact to the transportation system.

*More information is located here: http://www.nevadabusiness.com/2015/10/unmanned-aerial-vehicles-cultivating-a-new-industry-in-nevada/.

Hyperloop System

The Hyperloop system is a high-speed mode of travel, which could potentially reach a top speed of 760 miles per hour. The Hyperloop system involves building a full-length tube between destinations within which a transport pod carrying passengers or cargo is levitated by magnets and accelerated through a controlled environment. The system is intended to be carbon-free and powered by renewable energy.

There are several companies looking to bring the Hyperloop into reality. One company has chosen the Apex Industrial Park in the city of North Las Vegas, Nevada, as the location for initial testing.

More information is located here: http://www.cnbc.com/2015/12/09/hyperloop-technologies-choose-nevada-to-test-superfast-transport-system.html.

As these technologies emerge, transportation professionals will need to be mindful of how the transportation system will evolve. Appropriately planning for these technologies may help to maximize investment benefits by providing solutions for today and preparing for the future. As these technologies develop, there may be improvements to our transportation system that could accommodate or amplify the benefits of new technology.

Autonomous vehicles and the Hyperloop system both have the potential to shape a region's population, land use pattern, and traffic pattern. Being mindful of the success and timing of these transportation trends will help the Carson Area Metropolitan Planning Organization and its three member agencies successfully plan for the year 2040.

Further development of transportation technologies will greatly benefit the Carson area, through technology advancements, our transportation network will become more sustainable, efficient, and connected. The above emerging technologies have the ability to transform our transportation network through a multitude of benefits such as lowering pollution levels, faster transit times, and reducing vehicle crashes.